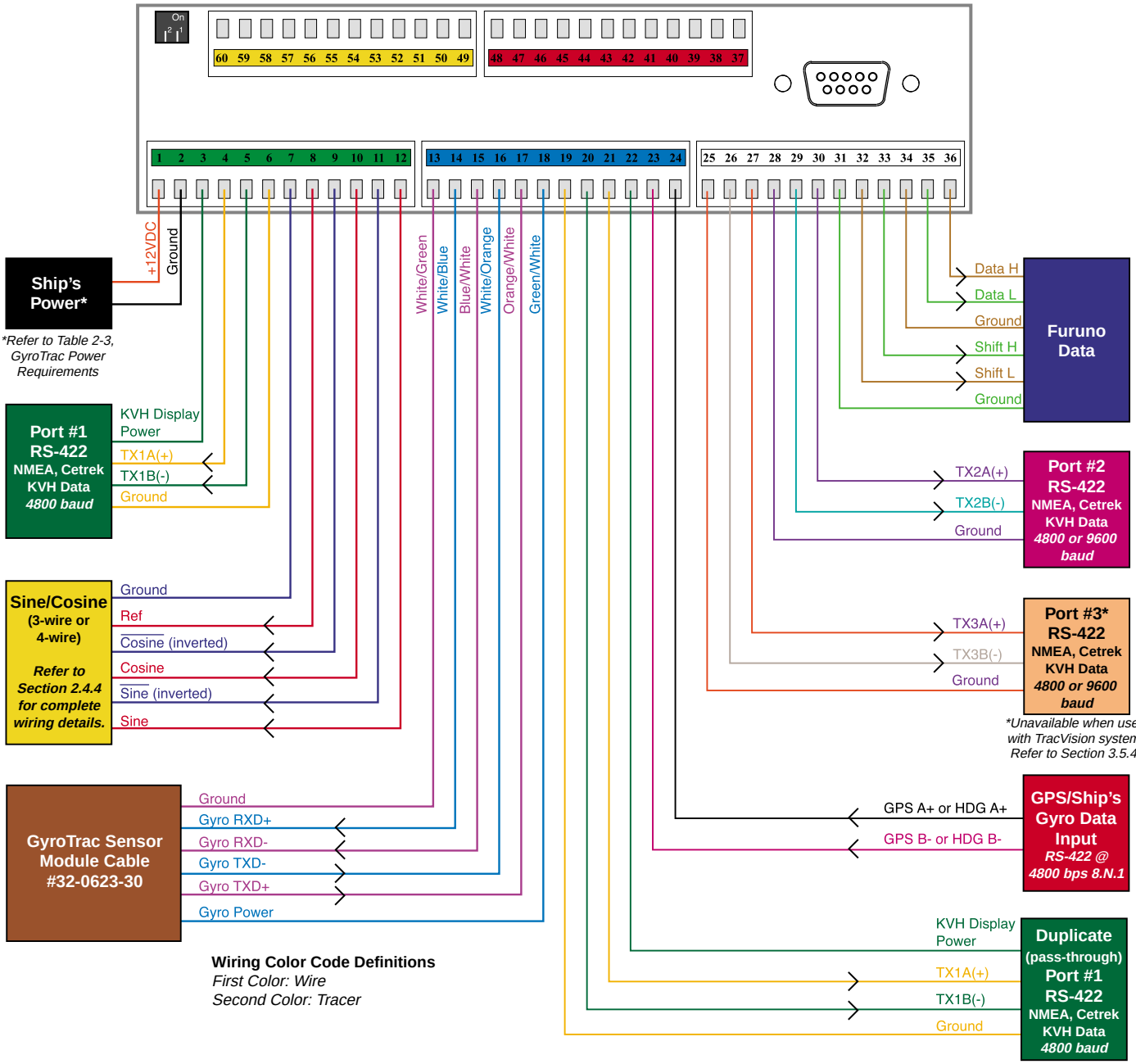
KVH Industries, Inc.

A Guide to GyroTrac

- **Installation Instructions**
- **User's Guide**
- **Technical Manual**

GyroTrac™

GyroTrac™ Wiring Quick Reference Guide



Wiring Color Code Definitions
First Color: Wire
Second Color: Tracer

Complete installation and wiring directions have been provided in *Section 2, Installation.*

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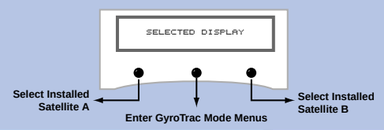
GyroTrac™ Menu Quick Reference Guide

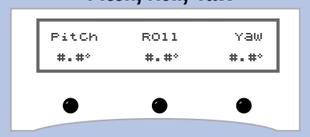
ADCU Primary Display Options



Compass Displays*

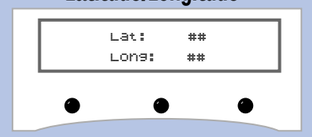
*True North Display requires GPS data

Pitch, Roll, Yaw



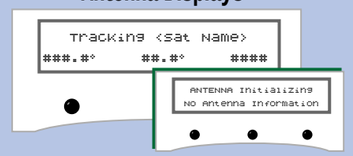
Rate of Turn

Latitude/Longitude†



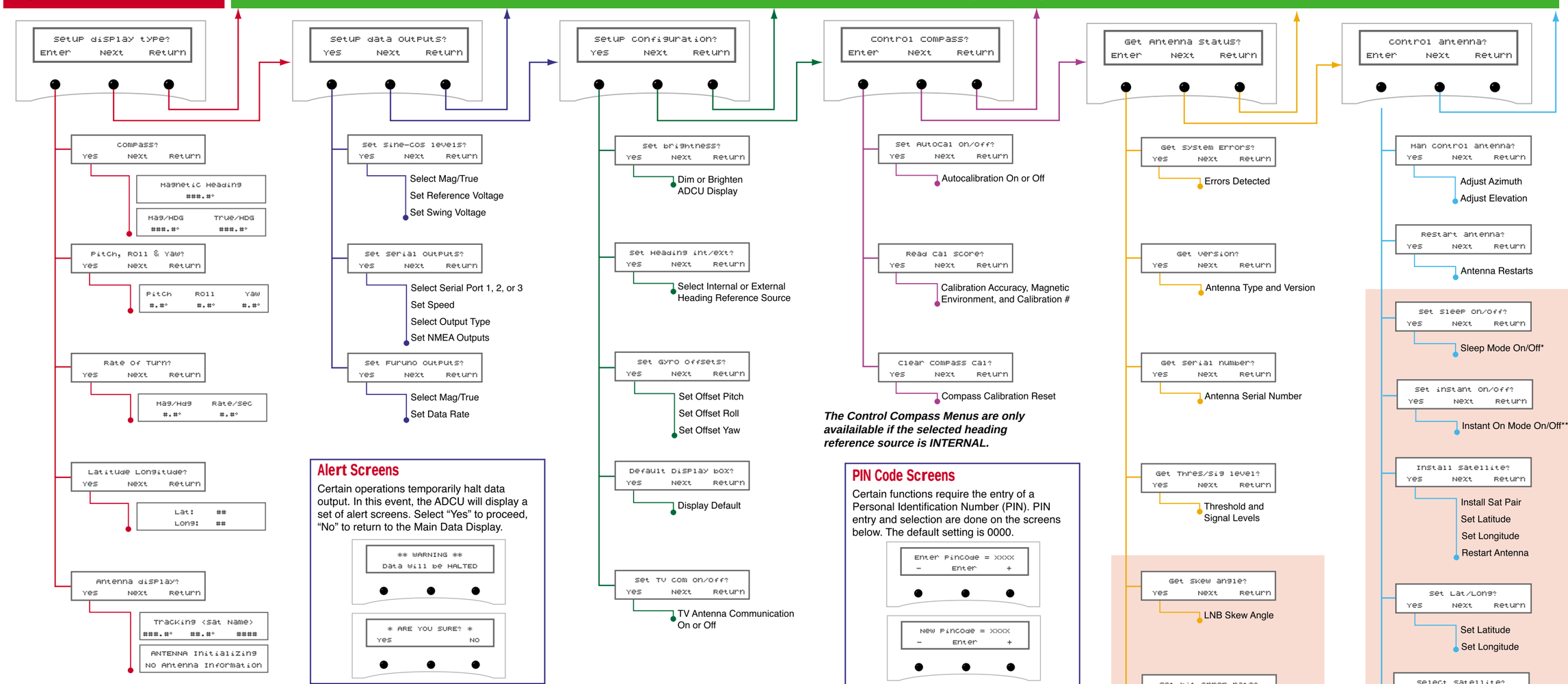
†Lat/Long Display requires GPS data

Antenna Displays



GyroTrac Mode Menus

Return to Selected Primary Display



Alert Screens

Certain operations temporarily halt data output. In this event, the ADCU will display a set of alert screens. Select “Yes” to proceed, “No” to return to the Main Data Display.

The Control Compass Menus are only availailable if the selected heading reference source is INTERNAL.

PIN Code Screens

Certain functions require the entry of a Personal Identification Number (PIN). PIN entry and selection are done on the screens below. The default setting is 0000.

* Sleep Mode only available on the following systems: TracVision 3 (antenna software version 4.20 or later), TracVision G4 (antenna software version 3.02 or later), and TracVision G6

** Instant On Mode only available on the following systems: TracVision G4 (antenna software version 3.27 or later) and TracVision G6

GyroTrac Owner's Manual Addendum

(ECO #5619)

The following changes have been made to Revision G of the GyroTrac Owner's Manual (KVH Part Number 54-0142).

Inside Front Cover

The quick reference guide on the inside front cover has been changed as follows:

1. The PIN Code Screens box has been deleted.
2. A menu item has been added to the column headed by "Control antenna?" (see Figure A below).

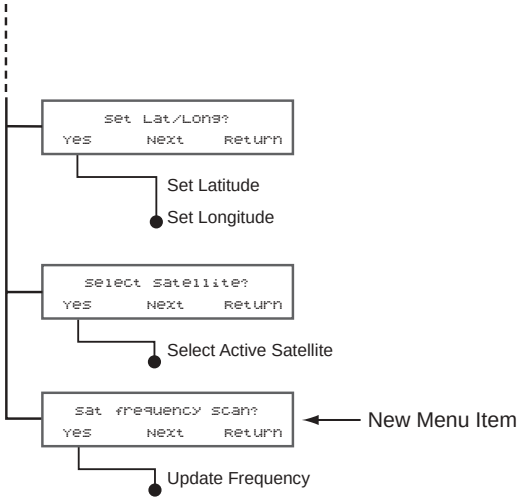


Figure A
New Menu Item on Quick Reference Guide

3.2.3 System Security

This section of the manual has been deleted. The little-used security option is no longer available.

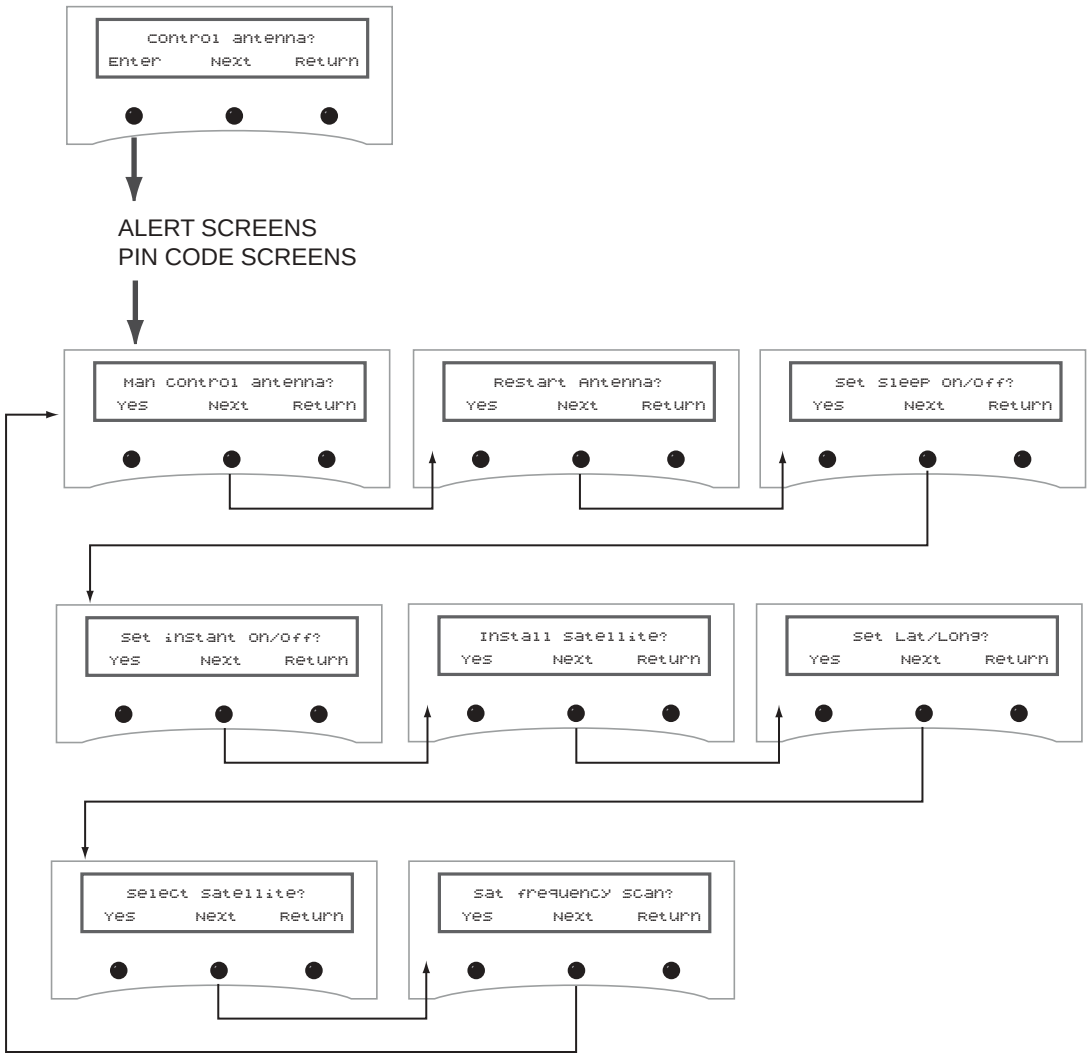
3.8 Control Antenna Mode

A new software feature has been added to the GyroTrac system – Satellite Frequency Scan. If the GyroTrac is connected to a TracVision G4 or TracVision G6, this option allows you to update the frequency data of any satellite stored in the system's library.

These screens are only seen if *Antenna Comm* is turned ON.

This sequence of steps allows a user to adjust the antenna's azimuth and elevation manually, restart the antenna, set Sleep Mode on or off, set Instant On Mode on or off, install a new pair of active satellites, set the latitude and longitude, select the active satellite system, and **update satellite frequency data**.

Figure 3-29
Control Antenna Mode Menu Sequence



3.8.7 Selecting Active Satellite

Figure 3-36 has been updated to include "Updating Satellite Frequency Data."

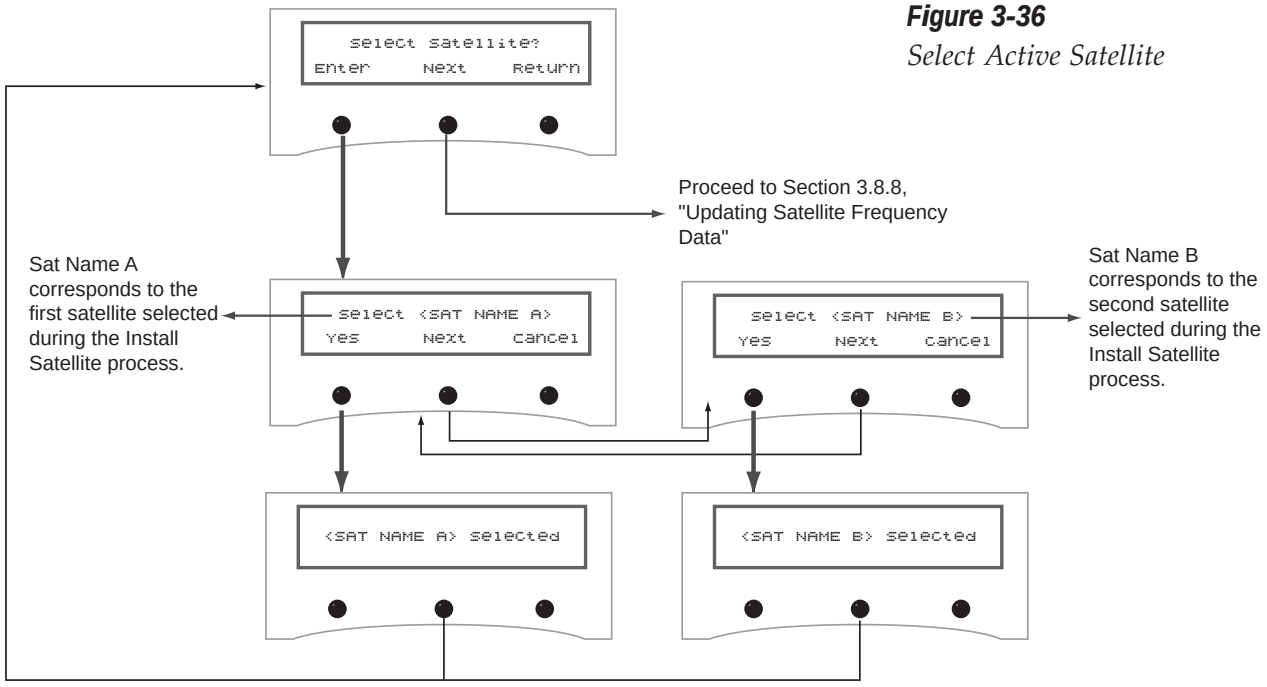


Figure 3-36
Select Active Satellite

3.8.8 Updating Satellite Frequency Data

These screens are only seen if the GyroTrac ADCU is connected to a TracVision G4 or TracVision G6.

If you select a channel but it doesn't appear on the TV, the satellite's frequency data may have changed. The Satellite Frequency Scan feature allows you to update the frequency data of any satellite stored in the system's library.

With the desired satellite, band, and polarization selected, the system will automatically search for the frequency with the strongest signal. The system will then update that satellite's programmed data with the new frequency (and associated network ID) and store it in the satellite library.

To update the satellite frequency data, perform the following:

1. Place your IRD in the satellite signal meter mode.
2. Select the desired satellite on the ADCU. ***Ensure the TV signal meter indicates that you have a strong signal.***

If the antenna is unable to find any channel on the selected satellite automatically, you can manually point the antenna using the Manual mode (see Section 3.8.1, "Manually Controlling the Antenna"*).*

3. Select the desired polarization and band on the IRD.

4. ***Do not move the vessel.*** Your boat must remain motionless during the entire Satellite Frequency Scan process.

5. Follow the ADCU menus on the next page. The scan itself will take a couple of minutes. Once complete, restart the antenna and ensure the antenna will track the new frequency.

If you are unsure about when and how to use the Satellite Frequency Scan feature, please contact your dealer/installer or distributor for assistance.3

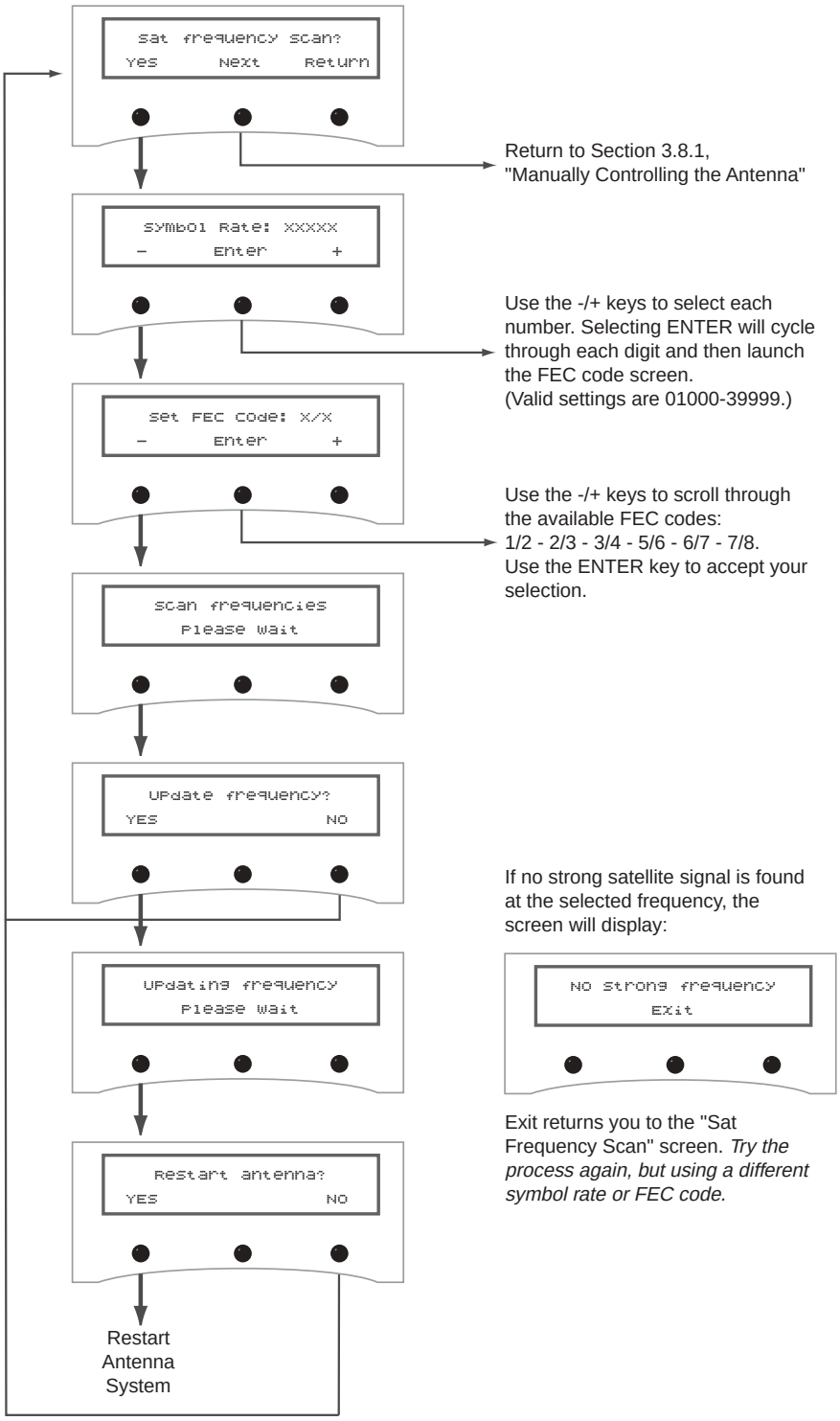

Sat frequency scan?
Yes Next Return
Return to Section 3.8.1,
"Manually Controlling the Antenna"
Symbol Rate: XXXXX
– Enter +
Use the -/+ keys to select each number. Selecting ENTER will cycle through each digit and then launch the FEC code screen.
(Valid settings are 01000-39999.)
Set FEC Code: X/X
– Enter +
Use the -/+ keys to scroll through the available FEC codes:
1/2 - 2/3 - 3/4 - 5/6 - 6/7 - 7/8.
Use the ENTER key to accept your selection.
Scan frequencies
Please Wait
Update frequency?
YES NO
If no strong satellite signal is found at the selected frequency, the screen will display:
Updating frequency
Please Wait
No strong frequency
Exit
Exit returns you to the "Sat Frequency Scan" screen. Try the process again, but using a different symbol rate or FEC code.
Restart antenna?
YES NO
Restart Antenna System

Figure 3-37
Satellite Frequency Scan

To find a valid symbol rate and FEC code, refer to an up-to-date satellite table either in a magazine or on the Internet. For your convenience, this data is available (for the system's predefined satellites) on our web site at www.kvh.com/footprint/index.html.

GyroTrac User's Manual Addendum

(ECO #5208)

The following changes have been made to Revision G of the GyroTrac User's Manual (KVH Part Number 54-0142).

2.5 Connecting to Vessel Power

The ADCU now has 2 fuses, a 1-amp fuse on the lower printed circuit board (PCB) and a 4-amp fuse on the upper PCB. Therefore, the sidebar tip should no longer refer to just one 1-amp fuse.

*The ADCU is equipped with **fuses** to protect against high-voltage spikes. If the system is installed correctly and power is available, but the system is non-functional, refer to* Section 4, "Troubleshooting," *for instructions on checking and replacing the **fuses**.*

4 Troubleshooting

The two fuses in the ADCU differ in rating, as noted in the revised troubleshooting section.

Issue 2:

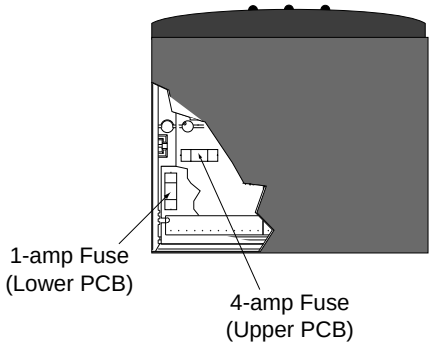
System is installed correctly and power is available, but the system is non-functional.

Solution:

Check the **fuses** within the ADCU. Remove the two screws securing the top and the base of the ADCU. Remove the top of the ADCU. The **fuses** are secured in brackets on the upper and lower printed circuit boards (PCBs) within the unit. Remove the damaged fuse and replace with a new, functional **fuse**.

Note: The fuse on the lower (main) PCB is a 1-amp fast blow fuse. The fuse on the upper (interface) PCB is a 4-amp fast blow fuse.

Figure 4-1
ADCU Fuse Locations (Top Cutaway)



5.2 Replaceable Parts

The Gyrotrac ADCU now contains two different fuses, necessitating the addition of the 4-amp fuse to the parts list.

Table 5-1
Field Replaceable Units

FRU	KVH Part No.
Sensor Module	02-0991
ADCU	02-0961
Flush Mount ADCU Panel	20-0667
Horizontal Sensor Bracket	20-0658
Vertical Sensor Bracket	20-0666
Connector Wire Terminal Strip	23-0223-12
Sensor to ADCU Data Cable	32-0623-30
ADCU Main PCB Fuse, 1-amp	**16-0009-1000**
ADCU Interface PCB Fuse, 4-amp	**16-0017-4000**

GyroTrac Owner's Manual Addendum

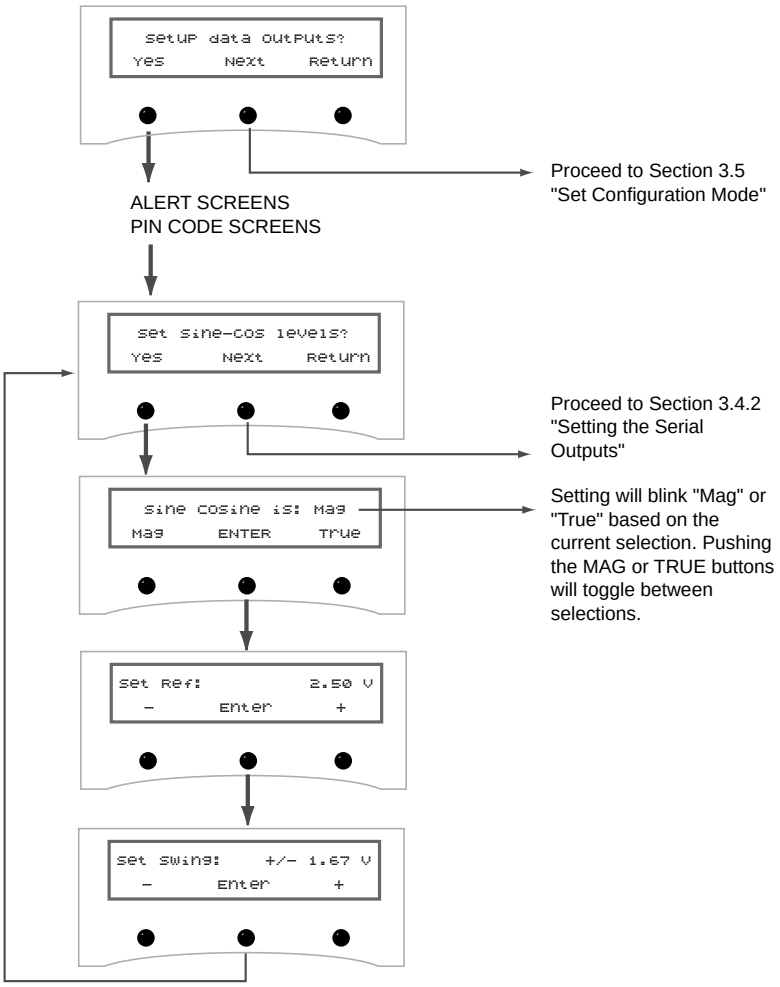
(ECO #5206)

Due to a software revision designed to improve the GyroTrac's operation and user interface, some of the menu displays have been modified. The following pages of Revision G of the GyroTrac Owner's Manual (KVH Part Number 54-0142) have been updated to reflect these changes.

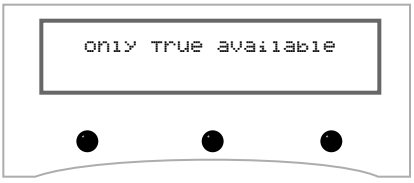
3.4.1 Setting the Sine/Cosine Data Output

The sine/cosine setup is done in three stages: first the magnetic or true heading option is selected, then the reference voltage is set, and finally the swing voltage is set. The valid range for reference and swing voltages is between 0 and 6.5 volts. **The default value for reference voltage is 2.5 volts. The default value for swing voltage is +/- 1.67 volts.** Refer to your autopilot manual for correct voltage requirements.

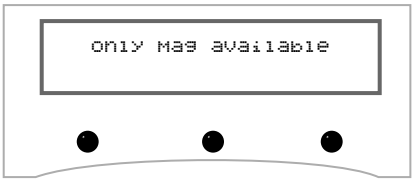
Figure 3-13
Setting Sine/Cosine Data Output



If the GyroTrac is receiving data from a ship's gyro, all compass outputs are automatically configured as True North and cannot be set as Magnetic. If this is the case, the following variation on the magnetic/true selection screen will be displayed:



If the system is NOT connected to a GPS or a ship's gyro, only magnetic heading data will be available and the following variation on the magnetic/true selection screen will be displayed:

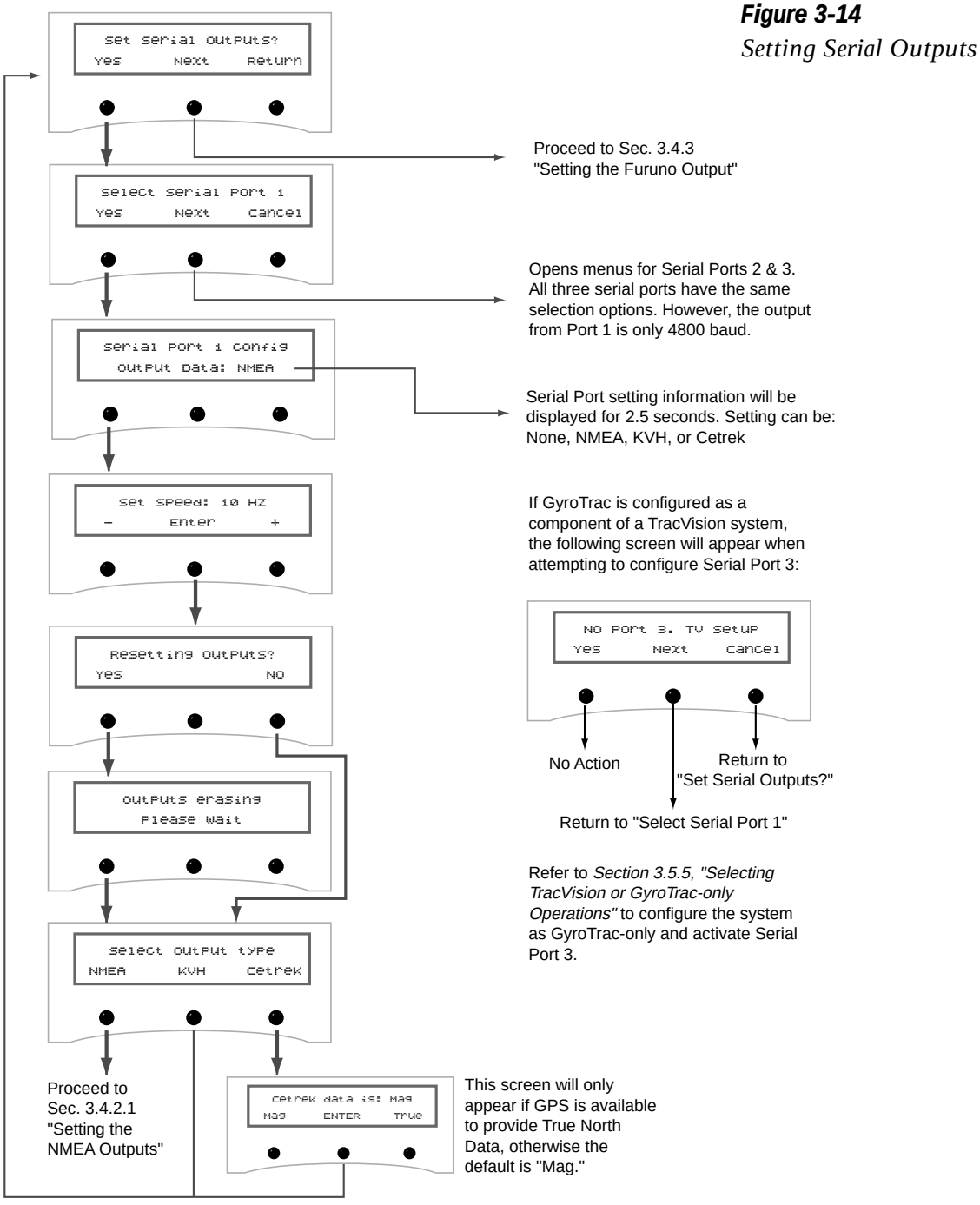


The system will then proceed to the "Set Ref" screens.

3.4.2 Setting the Serial Outputs

The GyroTrac can output up to three serial messages simultaneously in any combination of NMEA version 2.2, KVH RS-422, or Cetrek proprietary format. NMEA message options and the KVH and Cetrek formats are described briefly in *Appendix C.* Follow the procedures illustrated below to set the serial outputs. The factory default speed setting is 10 Hz.

Figure 3-14
Setting Serial Outputs

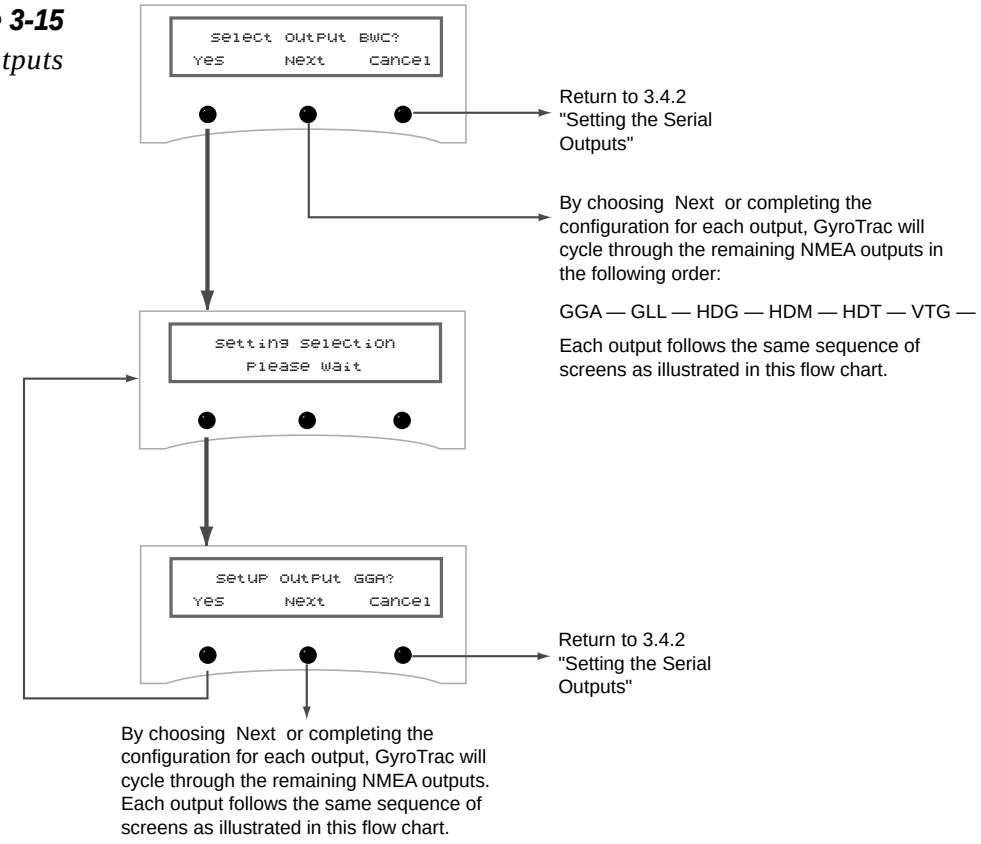

Set serial outputs?
Yes Next Return
Proceed to Sec. 3.4.3
"Setting the Furuno Output"
Select serial port 1
Yes Next Cancel
Opens menus for Serial Ports 2 & 3.
All three serial ports have the same selection options. However, the output from Port 1 is only 4800 baud.
Serial port 1 config
Output Data: NMEA
Serial Port setting information will be displayed for 2.5 seconds. Setting can be: None, NMEA, KVH, or Cetrek
Set speed: 10 Hz
– Enter +
If GyroTrac is configured as a component of a TracVision system, the following screen will appear when attempting to configure Serial Port 3:
Resetting outputs?
Yes NO
NO Port 3. TV setup
Yes Next Cancel
No Action
Return to "Set Serial Outputs?"
Return to "Select Serial Port 1"
Outputs erasing
Please Wait
Refer to *Section 3.5.5, "Selecting TracVision or GyroTrac-only Operations"* to configure the system as GyroTrac-only and activate Serial Port 3.
Select output type
NMEA KVH Cetrek
Proceed to Sec. 3.4.2.1 "Setting the NMEA Outputs"
Cetrek data is: Mag
Mag ENTER True
This screen will only appear if GPS is available to provide True North Data, otherwise the default is "Mag."

Custom configurations are not available on GyroTrac at this time.

3.4.2.1 Setting the NMEA Outputs

GyroTrac is fully compatible with NMEA *input* versions 1.5 and 2.2. However, the individual serial ports can only be programmed to use NMEA version 2.2 as an *output*.

Figure 3-15
Setting NMEA Outputs


Select OutPut BWC?
Yes Next Cancel
Return to 3.4.2 "Setting the Serial Outputs"
By choosing Next or completing the configuration for each output, GyroTrac will cycle through the remaining NMEA outputs in the following order:
GGA — GLL — HDG — HDM — HDT — VTG —
Each output follows the same sequence of screens as illustrated in this flow chart.
Setting Selection
Please Wait
SetUP OutPut GGA?
Yes Next Cancel
Return to 3.4.2 "Setting the Serial Outputs"
By choosing Next or completing the configuration for each output, GyroTrac will cycle through the remaining NMEA outputs. Each output follows the same sequence of screens as illustrated in this flow chart.

When Serial Ports 2 or 3 are selected to provide NMEA output, the baud rate is automatically changed to 4800 baud from the default of 9600 baud. Serial Port 1 and its pass-through duplicate only provide 4800 baud output.

3.5.4 Choosing the Default Display

This option resets the ADCU display settings to their factory defaults (i.e., compass, 50 percent brightness).

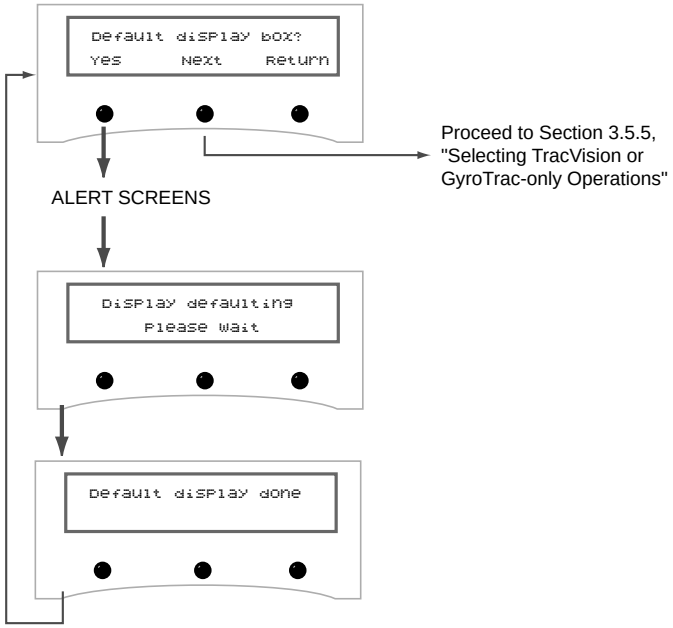


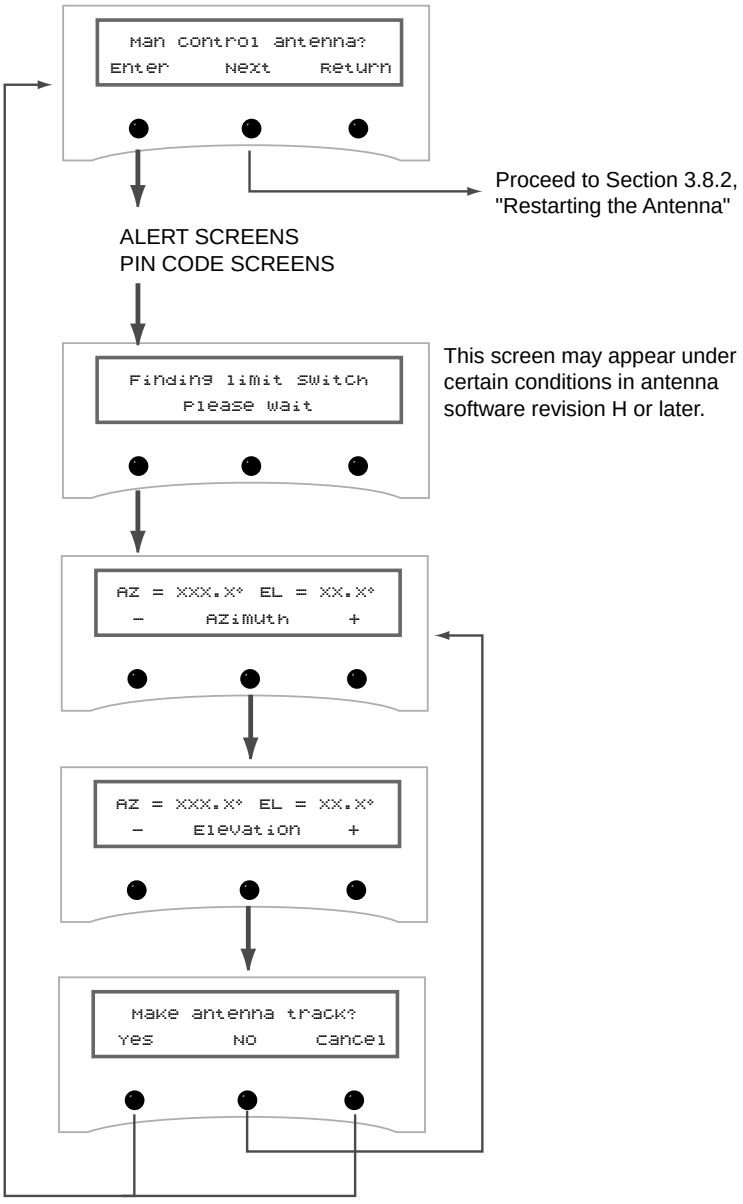
Figure 3-21
Selecting the Default Display

3.8.1 Manually Controlling the Antenna

These screens are only seen if *Antenna Comm* is turned ON.

In certain circumstances, it may be necessary to control the azimuth, elevation, and tracking of the TracVision G4 or TracVision G6 antenna manually, using the process illustrated in Figure 3-30. Use +/- to manually move the dish. Azimuth measurements are reported as relative to the bearing of the vessel's bow.

Figure 3-30
Manual Antenna Control Procedure


Man control antenna?
Enter Next Return
Proceed to Section 3.8.2, "Restarting the Antenna"
ALERT SCREENS
PIN CODE SCREENS
Finding limit switch
Please Wait
This screen may appear under certain conditions in antenna software revision H or later.
AZ = XXX.X° EL = XX.X°
– AZimuth +
AZ = XXX.X° EL = XX.X°
– Elevation +
Make antenna track?
Yes NO Cancel

If the system started up in Instant On mode, the following message may be displayed:

If the manual adjustment of the antenna reached the maximum rotation (720°), the antenna will rotate 360° and return to the Manual Antenna Control screens.

YES tells the antenna to begin actively tracking the set azimuth and elevation. NO leaves the antenna halted in its current position.

Congratulations!

You have selected one of the most advanced heading sensors available today. KVH® Industries' GyroTrac™ offers stabilized heading data as well as outputs compatible with most other onboard systems, including radar and autopilot. GyroTrac also serves as the external sensor for GyroTrac-compatible TracVision® satellite television systems. This manual provides detailed instructions on the proper installation, use, and maintenance of your GyroTrac system.

Throughout this manual, important information is marked for your attention by these icons:

A helpful tip that either directs you to a related area within the manual or offers suggestions on getting the highest quality out of your system.

An alert to important information regarding procedures, product specifications, or product use.

Information about installation, maintenance, troubleshooting, or other mechanical issues.

An electrical safety warning to help identify electrical issues that can be a hazard to either this KVH product or a user.

Direct questions, comments, or suggestions to:

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GyroTrac Serial Number

This serial number will be required for all troubleshooting or service calls made regarding this product.

KVH Part # 54-0142 Rev. G
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Table of Contents

1 Introduction 1-1

1.1 GyroTrac Overview 1-1

1.2 The GyroTrac System 1-1

1.3 Materials Provided with GyroTrac 1-3

2 Installation 2-1

2.1 Choosing the Best Location 2-2

2.1.1 Mounting on Steel Vessels 2-3

2.2 Mounting the Sensor Module 2-3

2.3 Mounting the ADCU 2-6

2.4 Wiring the GyroTrac 2-7

2.4.1 Connecting the GyroTrac to External Devices 2-10

2.4.2 GyroTrac Wiring Diagram 2-10

2.4.3 Wiring an Optional GyroTrac-compatible TracVision System 2-12

2.4.4 Wiring the GyroTrac Sine/Cosine Interface 2-12

2.4.5 True North Capability 2-13

2.5 Connecting to Vessel Power 2-13

2.6 Calibrating the Sensor Module 2-14

2.6.1 Compensating the GyroTrac 2-14

2.6.2 The Calibration Score 2-15

2.7 Completing the Installation 2-15

3 Interface Configuration and Operation 3-1

3.1 Startup and Self-test 3-1

3.1.1 TracVision Startup and Self-test Screens 3-2

3.2 Data Display and Accessing the Main Menu 3-3

3.2.1 Main Menu 3-4

3.2.2 Alert Screens 3-5

3.2.3 System Security 3-5

3.2.4 The RETURN and CANCEL Keys 3-6
3.2.5 Antenna Error Messages 3-6
3.3 Setup Display Mode 3-7
3.4 Set Data Outputs Mode 3-8
3.4.1 Setting the Sine/Cosine Data Output 3-9
3.4.2 Setting the Serial Outputs 3-10
3.4.2.1 Setting the NMEA Outputs 3-11
3.4.3 Setting the Furuno Output 3-12
3.5 Set Configuration Mode 3-13
3.5.1 Setting Display Brightness 3-14
3.5.2 Selecting Heading Reference Source 3-14
3.5.3 Entering Gyro Offset Values 3-15
3.5.4 Choosing the Default Display 3-16
3.5.5 Selecting TracVision or GyroTrac-only Operations 3-16
3.6 Control Compass Mode 3-17
3.6.1 Selecting Autocompensation 3-17
3.6.2 Reading the Calibration Score 3-18
3.6.3 Clearing Compass Calibration 3-18
3.7 Antenna Status Mode 3-19
3.7.1 Antenna Status Data Screens 3-20
3.8 Control Antenna Mode 3-21
3.8.1 Manually Controlling the Antenna 3-22
3.8.2 Restarting the Antenna 3-23
3.8.3 Turning Sleep Mode On/Off 3-23
3.8.4 Turning Instant On Mode On/Off 3-24
3.8.5 Installing a New Satellite Pair 3-25
3.8.6 Setting Latitude and Longitude 3-26
3.8.7 Selecting Active Satellite 3-27

4 Troubleshooting 4-1

5 Maintenance 5-1

5.1 Warranty/Service Information 5-1
5.2 Replaceable Parts 5-1

Appendix A System Specifications A-1

Appendix B Optional KVH Displays B-1
B.1 Optional Display Specifications B-1
B.2 Mounting the Pointer Analog and Digital Displays B-2
B.2.1 Mounting the Display Backlighting Control B-3
B.2.2 Wiring the Pointer Analog and Digital Displays B-3
B.2.3 Wiring the Backlight Control Switch B-4
B.3 Mounting the Rotating Card Display B-4
B.3.1 Bracket Mounting B-4
B.3.2 Panel Mountingq B-5
B.3.3 Wiring the Rotating Card Display B-5

Appendix C Data Outputs C-1
C.1 Sine/Cosine Output C-1
C.2 Serial Port Outputs C-1
C.3 Furuno Output C-4
C.3.1 Optional Stepper Components C-4

Appendix D ADCU Flush Mount Panel Template D-1

Appendix E Rotating Card Display Mounting Templates E-1
Template E-1 Rotating Card Display Bracket Mounting E-1
Template E-2 Rotating Card Display Panel Mounting E-3

List of Figures

Figure 1-1 GyroTrac Identifies and Compensates for Vessel Motion 1-1
Figure 1-2 GyroTrac Sensor Module 1-1
Figure 1-3 Front, Rear, and Angle View of GyroTrac ADCU 1-2

Figure 1-4	Possible GyroTrac System Configurations	1-2
Figure 1-5	GyroTrac Package Contents	1-3
Figure 2-1	Horizontal Sensor Bracket	2-3
Figure 2-2	Vertical Sensor Bracket	2-3
Figure 2-3	Proper Orientation of the Sensor Module	2-4
Figure 2-4	Securing the Sensor Module and the Horizontal Sensor Bracket	2-4
Figure 2-5	Optional Bracket Orientations	2-5
Figure 2-5a	Attaching the Horizontal and Vertical Brackets	2-5
Figure 2-6	Mounting the ADCU with Velcro Attachments	2-6
Figure 2-7	Securing the ADCU to the Flush Mount Bracket	2-7
Figure 2-8	Terminal Strip Order	2-8
Figure 2-9	Attaching the Terminal Strips to the ADCU	2-8
Figure 2-10	Examples of Effective Strain Relief Arrangements	2-9
Figure 2-11	Proper Wiring for Connectors 1-36 (GyroTrac)	2-11
Figure 2-12	Sample Calibration Score Screen	2-15
Figure 3-1	Startup and Self-test	3-1
Figure 3-2	Startup Error Screen	3-2
Figure 3-3	GyroTrac Startup Screens	3-2
Figure 3-4	Soft Key Functions and Main Data Displays	3-3
Figure 3-5	Main Menu Functions	3-4
Figure 3-6	Sample Alert Screens	3-5
Figure 3-7	PIN Code Screens	3-5
Figure 3-8	Erase PIN Code Screen	3-5
Figure 3-9	Incorrect Response Error Message	3-6
Figure 3-10	Non-responsive Antenna Error Message	3-6
Figure 3-11	Setting Display	3-7
Figure 3-12	Data Outputs Mode Menu Sequence	3-8
Figure 3-13	Setting Sine/Cosine Data Output	3-9
Figure 3-14	Setting Serial Outputs	3-10
Figure 3-15	Setting NMEA Outputs	3-11
Figure 3-16	Setting Furuno Output	3-12

Figure 3-17 Configuration Mode Menu Sequence 3-13
Figure 3-18 Display Brightness Controls 3-14
Figure 3-19 Internal/External Reference Menus 3-14
Figure 3-20 Entering Gyro Offset Values 3-15
Figure 3-21 Selecting the Default Display 3-16
Figure 3-22 Selecting TracVision- or GyroTrac-only Operations 3-16
Figure 3-23 Compass Control Mode Menu Sequence 3-17
Figure 3-24 Setting Autocompensation 3-17
Figure 3-25 Reading the Calibration Score 3-18
Figure 3-26 Clearing Compass Calibration 3-18
Figure 3-27 Antenna Status Mode Menu Sequence 3-19
Figure 3-28 Antenna Status Data Screens 3-20
Figure 3-29 Control Antenna Mode Menu Sequence 3-21
Figure 3-30 Manual Antenna Control Procedure 3-22
Figure 3-31 Restart Antenna Menu 3-23
Figure 3-32 Sleep Mode Menu 3-23
Figure 3-33 Instant On Mode Menu 3-24
Figure 3-34 Installing Satellite Pair Process 3-25
Figure 3-35 Set Latitude/Longitude Procedure 3-26
Figure 3-36 Select Active Satellite 3-27
Figure 4-1 ADCU Fuse Location (Top Cover Cut Away) 4-1
Figure 5-1 Data Cable Terminal Arrangement 5-2
Figure B-1 Display Options B-1
Figure B-2 Mounting the Analog/Digital Displays B-2
Figure B-3 Mounting the Display Backlighting Control Switch B-3
Figure B-4 Wiring the Backlight Control Switch B-4
Figure B-5 Rotating Card Display – Removing the Backplate B-5
Figure B-6 Rotating Card Display – Terminal Strip Wiring B-6
Figure B-7 Rotating Card Display – PC Board Jumpers and Connectors B-6
Figure C-1 Stepper Interface C-4

Figure C-2 Optional 6-70v Stepper Voltage Converter Wiring Diagram C-6

List of Tables

Table 1-1 GyroTrac Packing List 1-3
Table 2-1 Recommended Power Cable Specifications 2-1
Table 2-2 Kitpack Contents 2-2
Table 2-3 GyroTrac/Autopilot Sine/Cosine Wiring Arrangement 2-12
Table 2-4 GyroTrac Power Requirements 2-13
Table 2-5 Possible Compass Accuracy Levels 2-15
Table 5-1 Field Replaceable Units 5-2
Table 5-2 Data Cable Wiring/Terminal Assignments 5-2
Table A-1 System Performance A-1
Table A-2 Environmental Specifications A-1
Table A-3 Interface Assignments A-2
Table B-1 Display Specifications B-1
Table B-2 Display Cable Connections B-3
Table B-3 Rotating Card Display – Terminal Strip Wiring Details B-6
Table C-1 NMEA1 Magnetic Heading Output C-2
Table C-2 NMEA2 Magnetic Heading Output C-2
Table C-3 NMEA3 True Heading Output C-3
Table C-4 KVH Output C-3
Table C-5 Cetrek Output C-4
Table C-6 Stepper Interface Specifications C-5

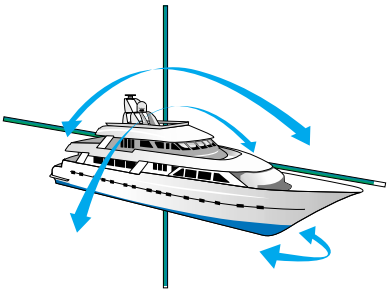
Color quick reference guides for GyroTrac wiring and menus have been provided on the inside front cover of this manual.

1 Introduction

1.1 GyroTrac Overview

Your KVH GyroTrac is designed for a variety of applications where an extremely accurate and reliable stabilized heading output is required. This means that the heading output is free of incidental movement by the host platform such as the pitch, roll, and yaw inherent in all dynamic applications. GyroTrac, in fact, eliminates all platform motion except actual changes in magnetic heading. It does this by measuring pitch, roll, and yaw with its gyroscope, digital compass, and inclinometer and correcting for these values in its microprocessor, effectively removing them. The result is accurate, drift-free heading output.

Figure 1-1
GyroTrac Identifies and Compensates for Vessel Motion



Although GyroTrac can be used as a stand-alone heading sensor, it can also be integrated with other equipment, including radars, autopilots, plotting systems, and computers. It is also fully compatible with the KVH TracVision® 3, TracVision G4, and TracVision G6 stabilized satellite TV systems. Its auto-compensation feature measures local magnetic field distortion and removes it, giving better than ±1˚ accuracy even on steel vessels, when mounted correctly.

Heading output is available as standard NMEA 0183 (HDT, HDM, or HDG), KVH heading, pitch, roll, and Cetrek™, plus user-configurable sine/cosine or B&G 4-wire sine/cosine, and Furuno® AD10S. A stepper unit (KVH Part Number 19-0078) is available as an optional interface module. True north output is available by interfacing with a GPS.

1.2 The GyroTrac System

GyroTrac consists of two key components: the Sensor Module and the Advanced Digital Control Unit (ADCU).

Figure 1-2
GyroTrac Sensor Module

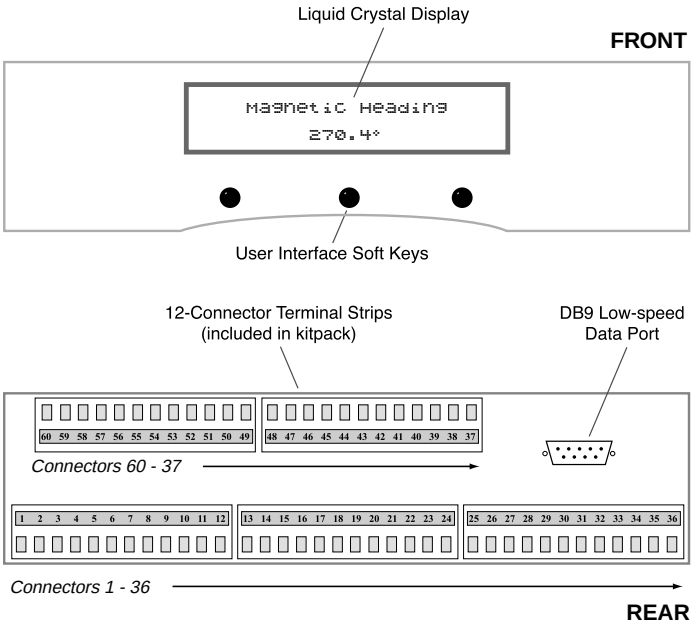
Sensor Module

The Sensor Module serves as the system's compass, housing the yaw sensor, inclinometer, rate gyros, and processing electronics. The Sensor Module is compliant with the IP67 standard, making the unit waterproof to a depth of 1 meter. The sensor module may be mounted above decks if desired.

Advanced Digital Control Unit (ADCU)

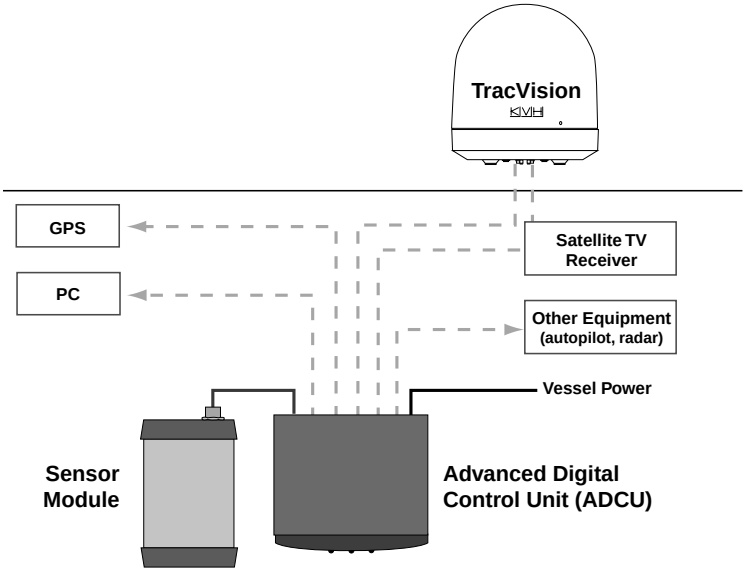
The ADCU is the user interface, providing access to the system and its functions through the LCD and three soft keys beneath it. The ADCU also serves as the system's junction box, allowing the system to use ship's power, interface with the Sensor Module, supply and receive data to and from a GyroTrac-compatible TracVision system, and supply and receive data from other shipboard systems.

Figure 1-3
Front, Rear, and Angle View of GyroTrac ADCU


Liquid Crystal Display
FRONT
Magnetic Heading
270.4°
User Interface Soft Keys
12-Connector Terminal Strips
(included in kitpack)
DB9 Low-speed
Data Port
60 59 58 57 56 55 54 53 52 51 50 49
48 47 46 45 44 43 42 41 40 39 38 37
Connectors 60 - 37
1 2 3 4 5 6 7 8 9 10 11 12
13 14 15 16 17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32 33 34 35 36
Connectors 1 - 36
REAR

The system is designed to interface with additional onboard equipment, as illustrated in Figure 1-4.

Figure 1-4
Possible GyroTrac System Configurations



If a GyroTrac-compatible TracVision system is connected to GyroTrac, the power supply to the TracVision MUST NOT exceed 16V or the TracVision power supply will suffer serious damage!

1.3 Materials Provided with GyroTrac

When you open your GyroTrac package, in addition to the cables and kitpack, you will find these components:

Table 1-1 lists the units, cables, and materials packed in the GyroTrac package by name and KVH part number.

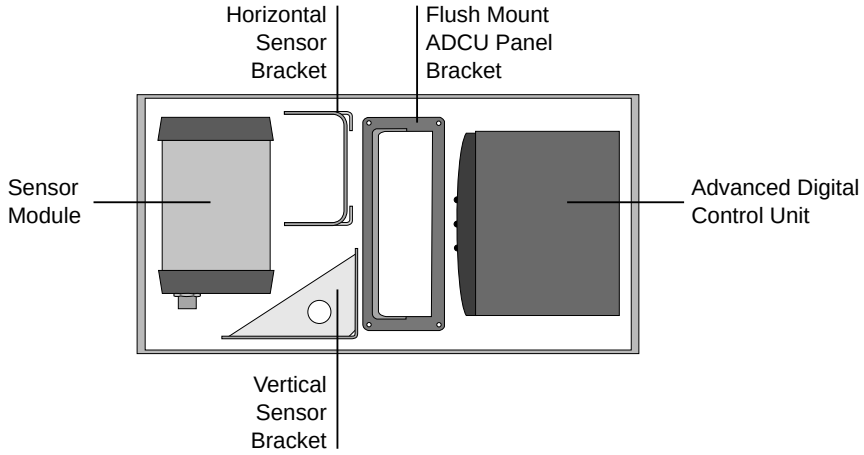


Figure 1-5
GyroTrac Package Contents

Table 1-1
GyroTrac Packing List

Component	KVH Part No.
Sensor Module	02-0991
ADCU	02-0961
Flush Mount ADCU Panel	20-0667
Horizontal Sensor Bracket	20-0658
Vertical Sensor Bracket	20-0666
Sensor to ADCU Cable (30 ft.)	32-0623-30
Kitpack*	72-0095

*A complete list of the kitpack contents is provided in *Section 2, "Installation."*

2 Installation

GyroTrac is designed for simple installation and setup. Just follow these easy steps:

1. The serial number of your GyroTrac will be required during any service or troubleshooting calls. The serial number is on the inside front cover of this manual, on the Sensor Module end cap, and on the back of the ADCU. The serial number for both components is the same.
2. Choose locations for the Sensor Module and ADCU.
3. Mount the Sensor Module.
4. Mount the ADCU.
5. Wire components together, to ship's DC system, and to onboard systems as appropriate.
6. Calibrate the sensor.

Plan the entire installation before proceeding! Take into account component placement, running cable distances between units and accessibility to the equipment after installation.

Recommended Tools and Materials

- Electric drill, assorted drill bits
- Light hammer; center punch; adhesive tape; scriber or pencil
- Phillips (long shank) and flat tip screwdrivers
- Wire strippers
- Power cable to connect ADCU to ship's power

Recommended Power Cabling

The following cable sizes are recommended for the specified running lengths and are based on Lloyd's and ABYC specifications. Cable jacketing should meet marine insulation standards while the cable should be tinned, stranded marine stock.

Cable Length	Cable Gauge
to 50 ft (15 m)	14 AWG (1 mm^2)
50-80 ft (25 m)	12 AWG (1.5 mm^2)
+80 ft (+25 m)	10 AWG (2.5 mm^2)

Table 2-1
Recommended Power Cable Specifications

Kitpack

Table 2-2 lists the materials provided in the GyroTrac kitpack.

Table 2-2
Kitpack Contents

Part	Qty.	KVH Part No.
#8 Fiber Washer	10	14-0239
#8 Flat Washer	10	14-0037
#8 Self-locking Nut	5	14-0065-08
#8 Pan (Phillips head) Screw	5	14-0041-06
#10 Flat Washer	5	14-0048
#10 Lock Washer	5	14-0049
#10 Pan (Phillips head) Screw	5	14-0051-03
#8 Pan (Phillips head) Screw	5	14-0243-05
#8 Lock Washer	5	14-0038
#8 Pan (Phillips head) Screw BP	5	14-0047-08
Velcro Self-Adhesive Backing	8	19-0146
Velcro Washer	4	19-0147
4" Tie-wrap Clamp	5	22-0013
Tie-wrap Screw Mount	6	22-0038
Connector Wire Terminal Strip	5	23-0223-12
Sensor Module to ADCU Power Wire Ferrite	1	29-0037-02

2.1 Choosing the Best Location

Be certain to isolate the Sensor Module from ground (i.e., the ship's hull) by always using the fiber washers when attaching the Horizontal Sensor Bracket to either a mounting surface or the Vertical Sensor Bracket.

Ideally, the GyroTrac sensor module should be mounted as low as possible in the center of the vessel – but *NOT* in the bilges.

- Place the Sensor Module as far as practical (minimum 3 ft./0.9 m) from magnetized or magnetizable materials.
- Maintain at least 4 feet (1.3 m) separation between the Sensor Module and any large ferrous masses, cables carrying high amperage direct current, or battery banks.
- Be alert for devices that change their magnetic characteristics when in use, such as CRTs, computer and TV screens, radar magnetrons, electric winches, loudspeakers, windshield wipers,

and other devices with DC motors. GyroTrac cannot compensate for changing magnetic fields created by these devices.

- Ensure that the ADCU is located within the running cable distance (30 ft./9.2 m) of the Sensor Module.
- If necessary to fabricate custom mounting brackets for the Sensor Module, they should be made from non-ferrous materials such as wood, brass, aluminum, fiberglass, or plastic.

2.1.1 Mounting on Steel Vessels

The GyroTrac sensor module is a digital magnetic compass and great care is required when positioning the unit on steel-hulled craft. The ideal location is in the wheelhouse or above decks. Mount on an aluminum pole or bracket, well away from magnetic fields such as cranes, derricks, motors, radomes, antennas, etc.

DO NOT mount the sensor module on a steel or iron platform. Use aluminum, brass, plastic, or wood.

If uncertain of the best location for the sensor module, make a temporary installation and conduct a compass calibration (as described in Section 2.6, "Calibrating the Sensor Module.*") Any necessary adjustments to the sensor location can be made based on the calibration scores.*

2.2 Mounting the Sensor Module

GyroTrac's Sensor Module comes equipped with two mounting brackets. The first is the Horizontal Sensor Bracket, which attaches directly to the Sensor Module housing, *and must be used in all mounting arrangements.*

The Vertical Sensor Bracket allows the Sensor Module to be mounted on a vertical surface. The following steps detail the correct use of each bracket.

These brackets should enable the Sensor Module to be placed as level in pitch and roll as possible. If you are unable to place the Sensor Module in a level arrangement, refer to *Section 3.5.3, "Entering Gyro Offset Values"* to compensate.

Figure 2-1
Horizontal Sensor Bracket

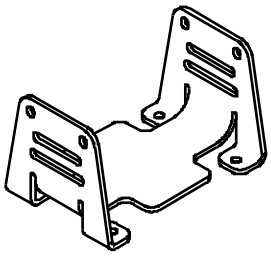


Figure 2-2
Vertical Sensor Bracket

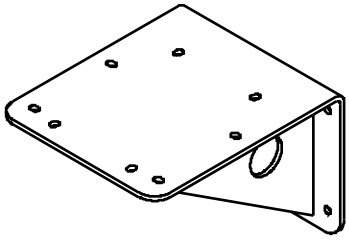
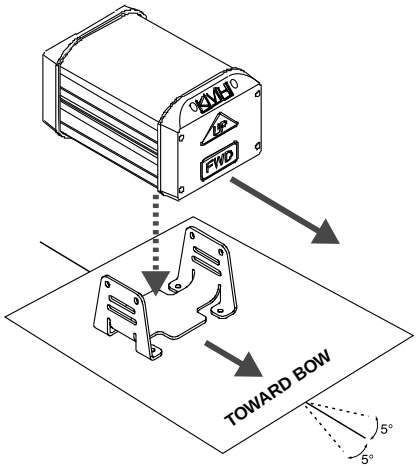


Figure 2-3
Proper Orientation of the Sensor Module

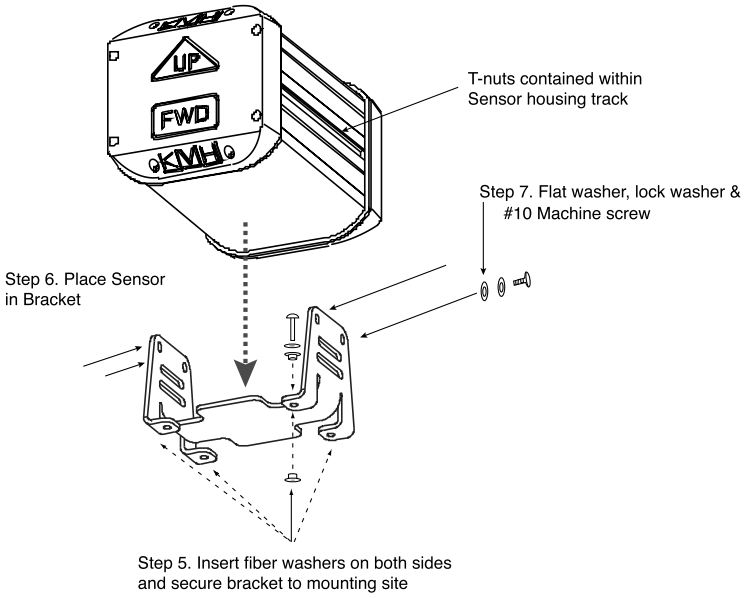


Should you ever need to replace the #10 machine screws used to secure the housing and bracket, the screws must be no longer than 3/8˝ to avoid damaging the housing.

Horizontal Bracket Only

1. Choose a mounting location free of excessive vibration and flexing.
2. The module must be oriented so that the forward reference on the end cap is pointed forward and parallel to the vessel's fore-and-aft axis (to ±5°). The proper orientation is illustrated in Figure 2-3.
3. Position the Horizontal Sensor Bracket so that the Sensor Module will be properly oriented when placed in the bracket.
4. Use the holes in the bracket feet to spot for mounting screws. Center punch and drill 4 holes with a 1/8˝ (0.125˝ or 3.5 mm) bit.
5. As illustrated in Figure 2-4, position the bracket over the mounting holes.
   - Insert fiber washers into both sides of mounting bracket.
   - Insert #8 flat washers and #8 pan head screws into the holes.
6. Place the Sensor Module in the bracket with the proper orientation (up/forward).
7. Thread #10 machine screws through lock washers, flat washers, and bracket, and then into the captive extrusion T-nuts within the Sensor Module housing as illustrated in Figure 2-4.

Figure 2-4
Securing the Sensor Module and the Horizontal Sensor Bracket


UP
FWD
KMH
T-nuts contained within Sensor housing track
Step 7. Flat washer, lock washer & #10 Machine screw
Step 6. Place Sensor in Bracket
Step 5. Insert fiber washers on both sides and secure bracket to mounting site

Horizontal and Vertical Bracket

1. Choose a mounting location free of excessive vibration and flexing.
2. The module must be oriented so that the forward reference on the end cap is pointed forward and parallel to the vessel's fore-and-aft axis. See Figure 2-3 for reference. The brackets are designed so that the Sensor Module may be mounted perpendicular (option 1) or parallel (option 2) to the mounting surface.
3. The module must be level with the vessel's deck. This placement can be fine tuned by using the ADCU pitch and roll data. Adjust the brackets so that the pitch and roll are 0 (zero) when the vessel is docked and under normal load.
4. When choosing a location for the unit, make certain that there is sufficient overhead clearance for both brackets *and* the Sensor Module.
5. Use the holes in the Vertical Sensor Bracket to spot for mounting screws. Center punch and drill 4 holes with a 1/8˝ (0.125" or 3.5 mm) bit.
6. Secure the Vertical Sensor Bracket to the vertical surface with #8 flat washer and #8 screws.
7. Attach the Horizontal Sensor Bracket to the Vertical Sensor Bracket as shown in Figure 2-5a.
   - Position the Horizontal Sensor Bracket over the mounting holes in the Vertical Sensor Bracket.
   - Insert fiber washers into both sides of mounting bracket.
   - Insert #8 flat washers and #8 pan head screws into the holes.
8. Place the Sensor Module in the bracket with the proper orientation (up/forward).
9. Thread #10 machine screws through lock washers, flat washers, and bracket, and then into the captive extrusion T-nuts within the Sensor Module housing.

Figure 2-5
Optional Bracket Orientations

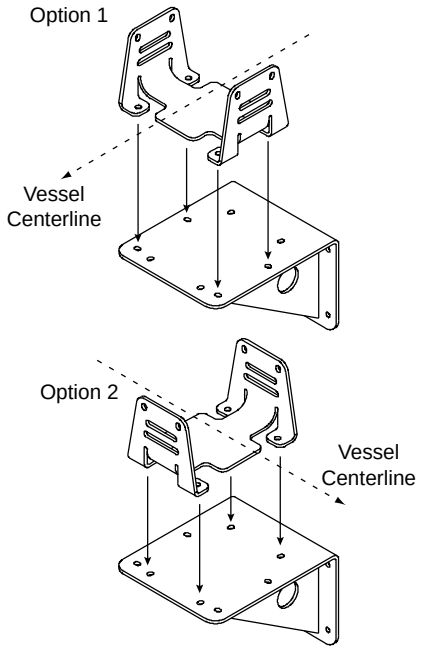
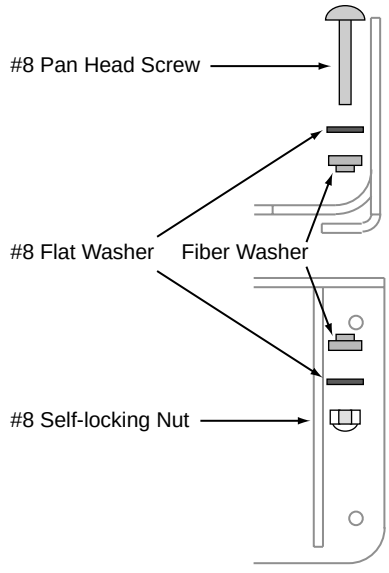


Figure 2-5a
Attaching the Horizontal and Vertical Brackets



2.3 Mounting the ADCU

When choosing a location, be certain to take into account the space required to route, position, and strain relieve all cables that will be attached to the back of the ADCU. Directions for proper wiring are presented in Section 2.4, "Wiring the GyroTrac."

The ADCU may be mounted in one of two ways: either directly to a horizontal surface using Velcro fasteners or flush to a control panel. Both the fasteners and the Flush Mount Bracket are included as part of the GyroTrac package.

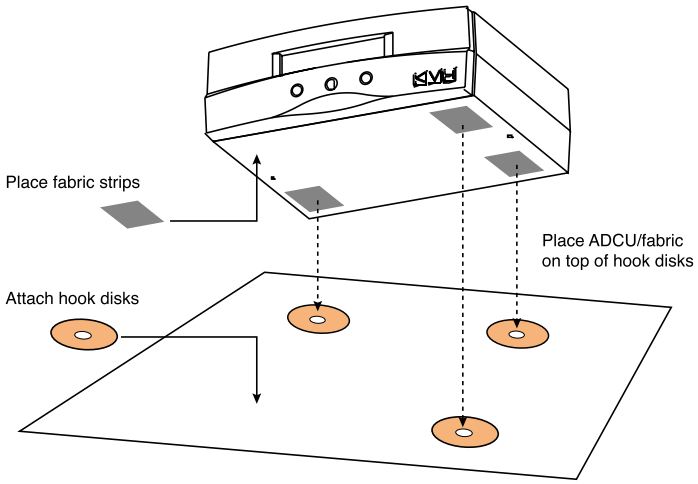
Some tips for installing the ADCU:

- The ADCU should be placed in a dry location that is convenient for the user.
- It is not susceptible to magnetic interference nor must it be situated on a level surface.
- It should be placed so the LCD display is visible and push buttons are accessible.
- Allow room at the back to connect cables to the rear panel.

Velcro Fastening

1. Choose a flat, stable location.
2. Remove the two strips of velcro fabric from the kitpack. Clean the bottom of the housing with a mild detergent and water to remove oils, etc. Peel the protective backing from the strips and apply them to the bottom of the housing at each of the four corners.
3. Position the four hook disks where the ADCU will be mounted. Drill screw holes for the disks and attach. Press the ADCU firmly into place so the loop material engages the hook disks.

Figure 2-6
Mounting the ADCU with Velcro Attachments



Flush-mounting the ADCU

1. A template has been provided in Appendix D as a guide to mark and cut the proper hole for the Flush Mount Bracket. Cut the hole and make certain the bracket and ADCU will fit easily.
2. Attach the Flush Mount Bracket to the ADCU by loosening the two screws on the underside of the ADCU. Slide the Flush Mount Bracket backward over the ADCU until the two notches meet the screws as shown in Figure 2-7.

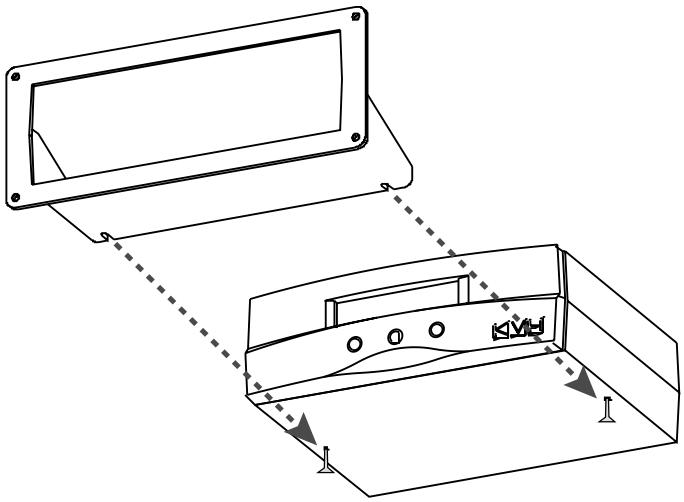


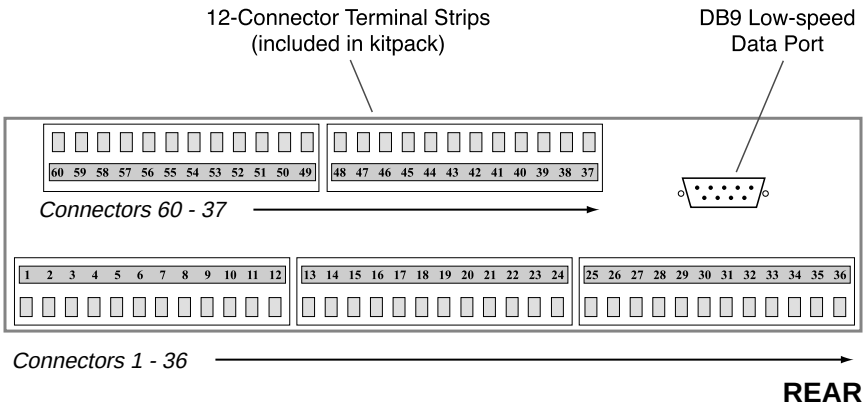
Figure 2-7
Securing the ADCU to the Flush Mount Bracket

3. Tighten the screws to secure the ADCU to the bracket.
4. After completing the wiring described in *Section 2.4, "Wiring the GyroTrac,"* insert the ADCU and bracket into the hole and secure the unit.

2.4 Wiring the GyroTrac

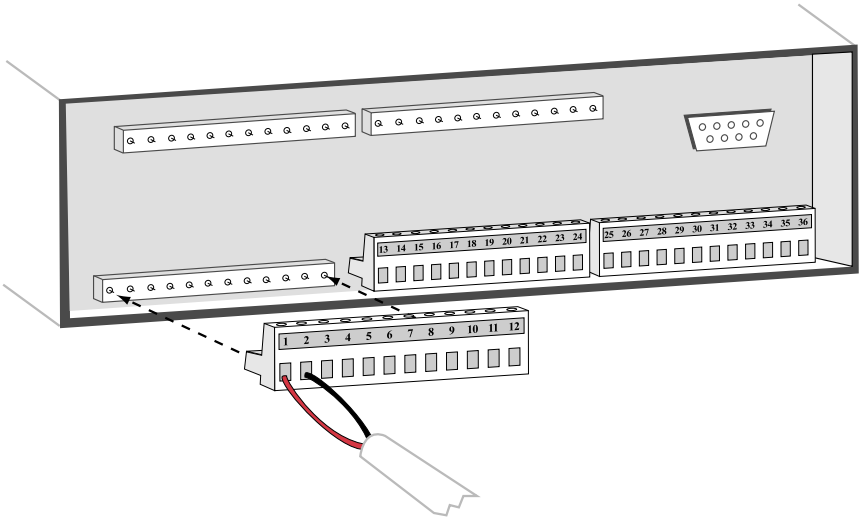
All wiring for the GyroTrac connects at the rear panel of the ADCU. Included in the GyroTrac kitpack are five terminal strips with terminal connectors numbered 1 through 60 (Figure 2-8 on the following page).

Figure 2-8
Terminal Strip Order



After wires are secured within the terminal connectors, the strips will be slotted into the rear panel of the ADCU as illustrated in Figure 2-9.

Figure 2-9
Attaching the Terminal Strips to the ADCU



Double-check all wiring. Be certain to plug terminal strips into the correct positions. If wiring is incomplete or incorrect or the terminal strips exchange positions, serious electrical damage can occur to the GyroTrac system and interfacing electronics.

Tips for Successful and Safe Wiring

- When inserting a wire into the terminal connector, make certain wire insulation is not pinched in the connector.
- After inserting and securing wire, tug gently to ensure that the connection is solid.
- Position cables behind ADCU so that they connect neatly to the terminal strips.
- Do not tin (solder) the wire ends.

Effective Strain Relief for ADCU Terminal Connections

Due to both the potential number of wires that will be connecting to the rear of the ADCU and the dynamic environment aboard ship, it is critical that the terminal connections are properly strain relieved using tie-wraps (a number of which are included with the GyroTrac kitpack).

Some things to consider when strain relieving cables:

- There should be no tension on the wires connecting to the terminal strip. Removing slack is important but the wires should not be taut.
- If the cable is equipped with a ferrite, the ferrite should be as close as possible to the terminal connections.
- Strain relieve wires and cables as close to the ferrite as possible. A good arrangement includes a tie-wrap behind the ferrite (on the side furthest from the ADCU); an ideal design includes a tie-wrap on either side of the ferrite.

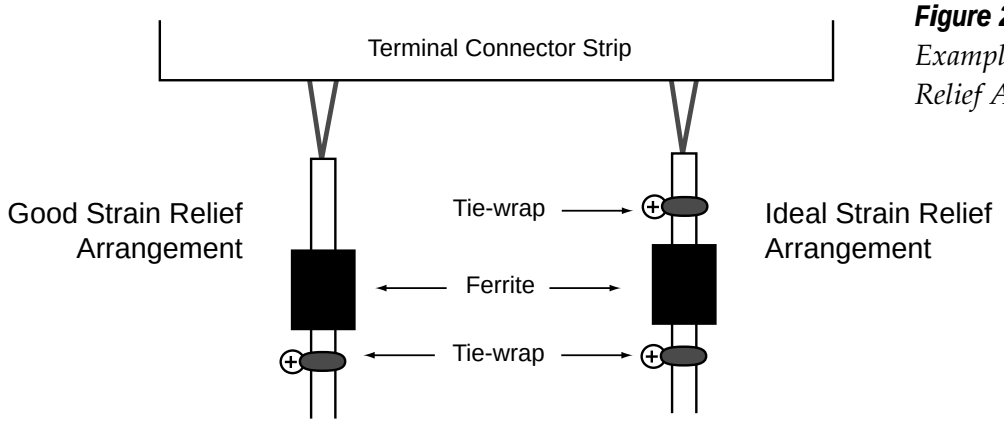


Figure 2-10
Examples of Effective Strain Relief Arrangements

2.4.1 Connecting the GyroTrac to External Devices

If the GyroTrac is receiving data from a ship's gyro, all compass outputs are automatically configured as True North and cannot be set as Magnetic.

All connections between the GyroTrac and external devices are made at the connector strips located on the rear of the ADCU. Follow these guidelines when wiring the GyroTrac to additional equipment:

- Make certain any additional equipment complies with NMEA Standard 2.2.
- Data conductor wire should be minimum 18 AWG (0.75 mm^2), twisted pair, stranded, tinned marine cable.
- Do not use cables with wire diameter larger than 12 AWG (2.5 mm^2), as the connector plugs on the rear of the ADCU accept wire no larger than 12 AWG (2.5 mm^2) size.
- Cables provided with optional KVH displays and interface units are fully compatible with GyroTrac requirements. Note that cables to other external devices should follow the manufacturer's recommendations.
- For power cable specifications, refer to Table 2-1 at the beginning of this section.

Section 3, "Interface Configuration and Operation," *presents details on configuring GyroTrac's serial ports to meet the output requirements of a variety of additional equipment.*

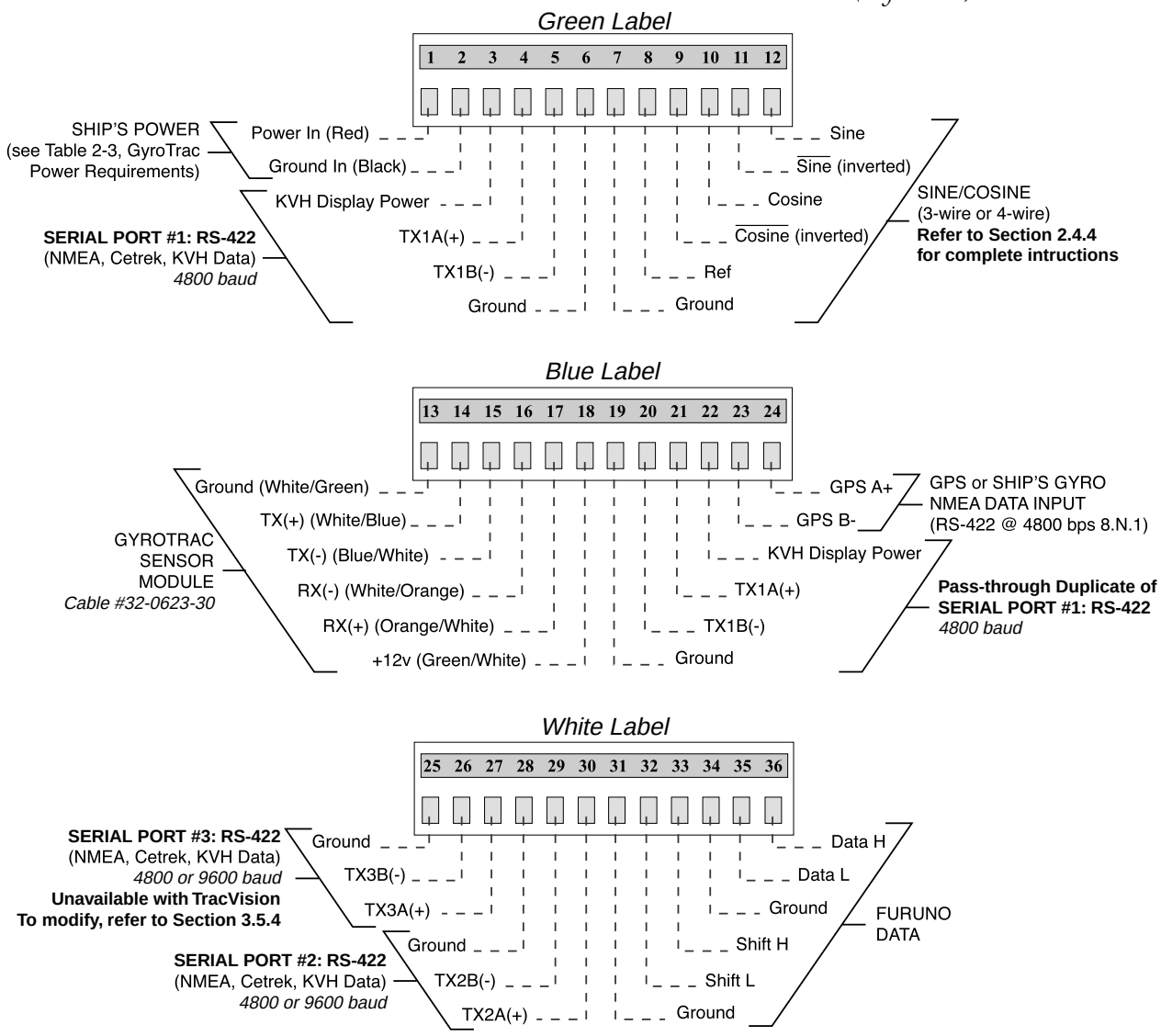
Appendix B provides instructions on properly wiring optional KVH equipment to the GyroTrac system.

2.4.2 GyroTrac Wiring Diagram

A color GyroTrac wiring quick reference guide has been provided on the front cover of this manual.

Figure 2-11 on the following page presents a complete wiring diagram for each GyroTrac terminal connector strip.

Figure 2-11
Proper Wiring for Connectors 1-36 (GyroTrac)



As noted in Figure 2-11, the output for Serial Ports 2 and 3 can vary from 4800 baud to 9600 baud. This is determined automatically based upon the selected output. Serial Port 1 provides 4800 baud output only.

When a TracVision antenna is connected to a GyroTrac system, Serial Port 3 will not provide output to other equipment. To restore Serial Port 3 operation, GyroTrac needs to be reconfigured for GyroTrac-only operation. Refer to Section 3.5.5, "Selecting TracVision or GyroTrac-only Operations."

2.4.3 Wiring an Optional GyroTrac-compatible TracVision System

The GyroTrac-compatible TracVision satellite TV system connects directly to the ADCU via the top two terminal connector strips. Refer to the appropriate TracVision user manual for complete instructions for wiring a GyroTrac-compatible TracVision system to the ADCU.

2.4.4 Wiring the GyroTrac Sine/Cosine Interface

The sine/cosine reference voltage is an OUTPUT, not an INPUT. Connecting this output to the reference output for an autopilot or other system can result in problems. Section 2.4.4 provides instructions on how to solve this problem.

The GyroTrac sine/cosine interface provides the following outputs:

- sine
- cosine
- inverse sine
- inverse cosine
- reference voltage

Because the reference voltage is a reference output, not an input, connecting this output to another reference output from an autopilot or other system will cause problems.

In this case, connect the following wires from the autopilot (or other system) to the GyroTrac:

Table 2-3
GyroTrac/Autopilot Sine/Cosine Wiring Arrangement

Autopilot/Other System Wire	ADCU Terminal
Sine	12
Cosine	10
Internal Power Ground *(not chassis ground!)*	7
Reference (INPUT)	*8 (KVH Output)*

DO NOT connect the autopilot or other system to the GyroTrac reference output (ADCU terminal 8) if the autopilot has its own internal reference. Review the user's manual for the selected equipment.

Before connecting the Autopilot internal ground to ADCU terminal 7, use a low impedance voltmeter to make certain that there is no DC voltage between the two terminals. A DC surge could damage one or both systems.

To adjust the GyroTrac reference to match the reference of the autopilot (or other system), connect a voltmeter to GyroTrac ADCU terminal (#8) and the reference terminal of the autopilot

(or other system). Adjust the GyroTrac reference voltage as described in *Section 3.4.1, Setting the Sine/Cosine Data Output*, until the voltmeter indicates 0 VDC.

The sine/cosine interface should now operate with optimal precision.

2.4.5 True North Capability

GyroTrac is capable of determining true north that is accurate, under most conditions, to within ±1.0˚. This information is obtained by providing GPS data input and reading the magnetic variance tables.

When the vessel is stationary, certain GPS models may not output the data required for GyroTrac to determine true north.

NMEA sentences from the GPS must contain one or all of the following sentences: VTG, VHW, or BWC. The sentence structure must comply with the NMEA 0183 V2.20 standard and run at 4800 bps 8.N.1.

As illustrated in Figure 2-11 and the quick reference guide on the cover of this manual, GPS interface cables connect to the ADCU at terminals 23 and 24. Refer to your GPS user manual for the correct NMEA data out configuration.

2.5 Connecting to Vessel Power

If a GyroTrac-compatible TracVision system is connected to GyroTrac, the power supply to the TracVision MUST NOT exceed 16V or the TracVision power supply will suffer serious damage!

Short circuits may result in severe electrical shock or burns. Turn off vessel power and test the circuit to ensure that no power is present before connecting the power cable.

The power needs of the GyroTrac vary based on its use as either a standalone system or as a component of a GyroTrac-compatible TracVision system:

Table 2-4
GyroTrac Power Requirements

GyroTrac Function	Power Requirement
As GyroTrac System	12-32V DC
As Sensor for TracVision	11-16V DC

The GyroTrac system does not have a dedicated power control (ON/OFF switch). A quick-tripping circuit breaker or fuse should be installed between vessel power and the ADCU. Circuit overload protection should be rated for 5 amperes. For recommended power cable specifications, refer to Table 2-1 at the beginning of this section.

The ADCU is equipped with a 1-amp fuse to protect against high-voltage spikes. If the system is installed correctly and power is available, but the system is non-functional, refer to Section 4, "Troubleshooting," *for instructions on checking and replacing the fuse.*

You must compensate the GyroTrac Sensor Module after installation so that any errors due to metal and magnetism in your vessel are removed!

A complete explanation of the GyroTrac menus is provided in Section 3, "Interface Configuration and Operation." *Specifics regarding calibration are in* Section 3.6, "Control Compass Mode."

If vessel power fluctuates widely or is noisy, a wide-range DC/DC converter power supply should be installed. *Test the voltage and polarity before making connections to vessel power.*

If the user-supplied power cable has a drain or shielded wire, *do not* connect the drain or shield to either the ADCU or to ground.

2.6 Calibrating the Sensor Module

Although every Sensor Module is calibrated at the factory, hard and soft iron effects on the host platform can distort the local magnetic field, causing errors in the reported heading. These errors are minimized by proper location of the Sensor Module and are further removed by GyroTrac's autocompensation feature, which measures the surrounding magnetic field distortions and compensates for them, thereby removing the resulting heading errors and giving you a system with better than ±1˚ accuracy in most cases.

It is critical that the compensation procedure be performed and a good calibration score be achieved following GyroTrac's installation. This will ensure the accuracy of GyroTrac's measurements and the data it provides to your other onboard systems. Failure to properly calibrate the system may result in an autocalibration conducted under less-than-ideal circumstances. To ensure that some form of calibration occurs after installation, GyroTrac leaves the factory with its autocompensation feature turned on because any compensation is better than none. Autocompensation will automatically shut off if a Calibration Accuracy of <8˚ or better is recorded. However, <8˚ accuracy is insufficient for precision heading measurements. *KVH recommends that you follow the procedure outlined in the following sections to ensure that your system is calibrated properly.*

2.6.1 Compensating the GyroTrac

Select a calm day and a clear area. Avoid excessive pitching and rolling, as this can distort the compensation data.

1. Apply power to the GyroTrac and note your approximate heading so that you will know when you have completed a full circle.
2. Set the rudder to steer your boat at a slow, steady speed through a full circle that takes at least 2 minutes to complete. (Try to time your turn so

that it takes 30 seconds or more to turn 90º.) After completing a full circle, continue the process with a second circle. The circles do not need to be perfectly round as long as you make a complete 360º turn.

3. Once you have completed two full circles, your compass should be compensated. Check the calibration score as described in the next section.

2.6.2 The Calibration Score

Each compensation results in a calibration score, pictured in Figure 2-12, that is stored in the system's memory.

Figure 2-12
Sample Calibration Score Screen

ACC (Calibration Accuracy)

The ACC data indicates the degree of accuracy the GyroTrac will provide based on the quality of the last calibration. Table 2-5 lists the five possible accuracy levels.

Table 2-5
Possible Compass Accuracy Levels

ACC Score	Accuracy
<1˚	Better than 1˚
<2˚	Better than 2˚
<4˚	Better than 4˚
<8˚	Better than 8˚
BAD CAL	Recalibrate

MAGENV (Magnetic Environment)

The MAGENV score (GOOD, OK, POOR, BAD) indicates the quality of the installation location. If the quality is POOR or BAD, the Sensor Module probably should be moved to a more favorable magnetic environment.

CAL # (Calibration Update Number)

The CAL # indicates the number of times the deviation table has been updated. It is used primarily to verify whether a new calibration has been accepted by the system.

2.7 Completing the Installation

The physical installation of GyroTrac is now complete. *Section 3, Interface Configuration and Operation,"* provides detailed instructions on defining GyroTrac's operations and outputs.

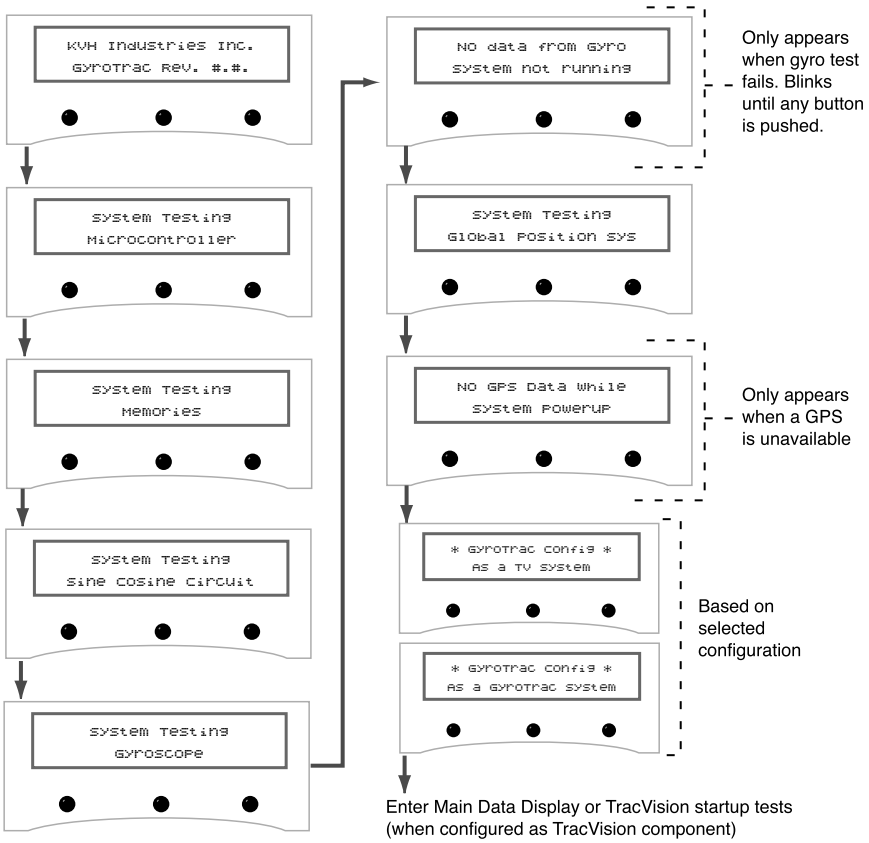
Be certain to fill out and return the warranty card to KVH.

3 Interface Configuration and Operation

All operations related to TracVision antennas and GyroTrac are controlled and monitored using the ADCU. An LCD screen displays navigation and configuration data and three soft keys enable a user to perform a multitude of menu-driven tasks.

3.1 Startup and Self-test

1. Turn on the IRD and the television receiver.
2. If a GPS receiver is connected, ensure that it has obtained an accurate position.
3. Apply operating power to the ADCU.
4. Wait while system conducts brief self-test sequence. Test status messages are displayed on the ADCU for approximately two seconds each.



A number of antenna-specific screens will only be available on the interface if a GyroTrac-compatible system is connected to the ADCU. Due to operational differences between TracVision 3, TracVision G4, and TracVision G6, certain screens will only be available when the appropriate system is connected to the ADCU. These screens are identified throughout this section.

Figure 3-1
Startup and Self-test

The absence of valid GPS data is not a fault; the status message simply indicates that GPS data is not present, and that those navigation functions that use GPS inputs are not available.

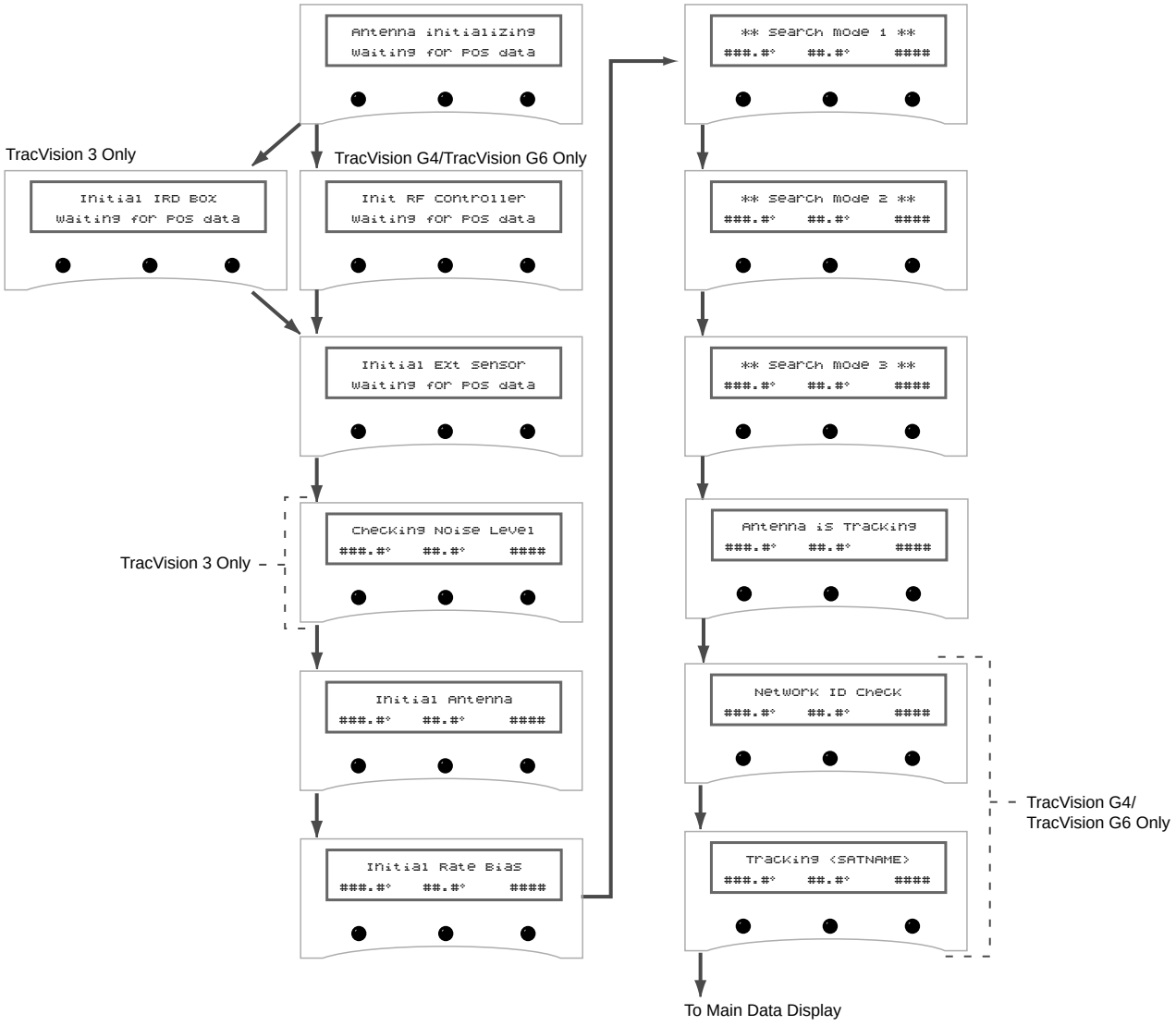
Figure 3-2
Startup Error Screen

If the self-testing routine detects faults in any of the first four self-tests, the screen pictured in Figure 3-2 is displayed. Operation halts at this point and the GyroTrac cannot operate. The unit should be returned to your local authorized KVH dealer, distributor, or service center.

3.1.1 TracVision Startup and Self-test Screens

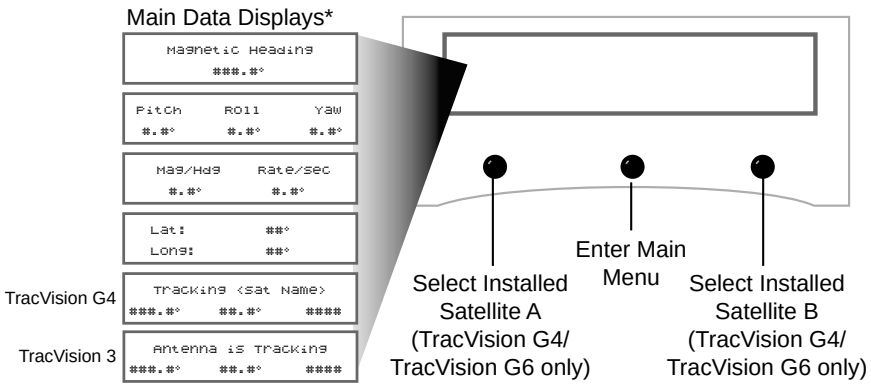
When configured as a component of a TracVision system, GyroTrac conducts a series of startup routines and self-tests to verify antenna operation. The TracVision self-test status screens are *only* displayed when the main data display is set to show the antenna status information (as described in *Section 3.3, "Setup Display Mode"*).

Figure 3-3
GyroTrac Startup Screens



3.2 Data Display and Accessing the Main Menu

As soon as the self-test routine is completed, the LCD panel shows one of five data displays selected in the Display Setup Mode (described in *Section 3.3, "Setup Display Mode"*). When any of the primary data displays are on screen, the soft keys allow you to switch between the two installed satellites (if GyroTrac is connected to a TracVision G4 or TracVision G6) as well as enter the Main Menu mode. The key functions and display options are as follows:



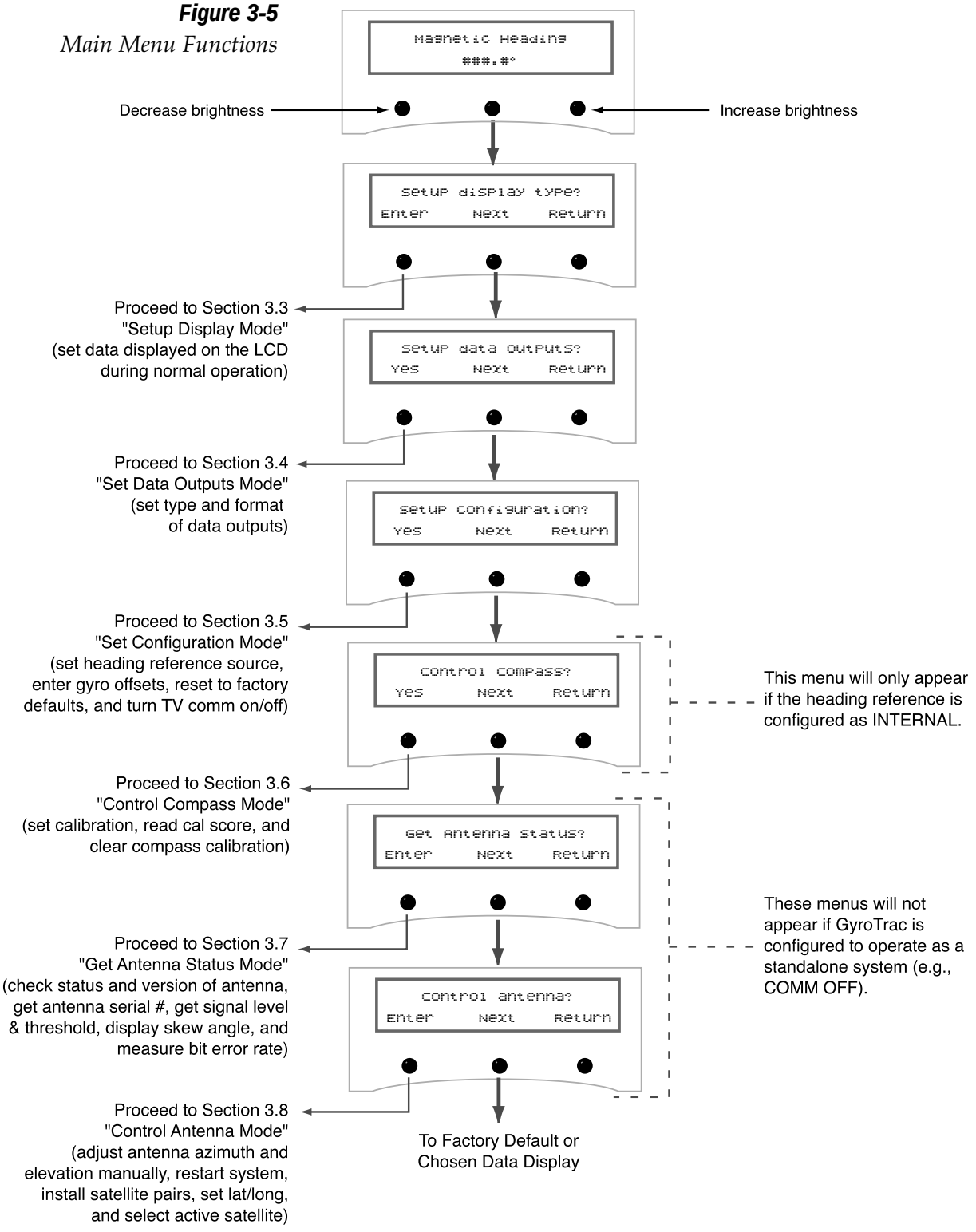
* Variations on these displays are also presented in Figure 3-11.

Figure 3-4
Soft Key Functions and Main Data Displays

3.2.1 Main Menu

Pressing the center key will cycle the Main Menu through the available functions as follows:

Figure 3-5
Main Menu Functions



3.2.2 Alert Screens

Certain operations require GyroTrac to temporarily cease its data output or alter its configuration so that new parameters or configurations may be entered. When you enter one of these functions, a pair of alert screens will appear, informing you of what will happen. Selecting "Yes" will allow you to continue into the function. Selecting "No" will return you to the Main Menu.

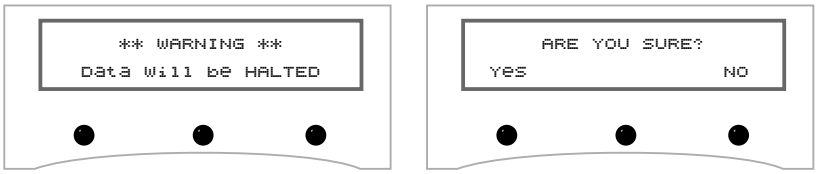


Figure 3-6
Sample Alert Screens

3.2.3 System Security

To prevent unauthorized adjustments to certain GyroTrac settings, certain functions require the entry of a customizable 4-digit Personal Identification Number (PIN). PIN entry and selection procedures are illustrated below. The default setting for the PIN is four zeros (0000). If an incorrect PIN is entered, the system automatically returns to the main data display.

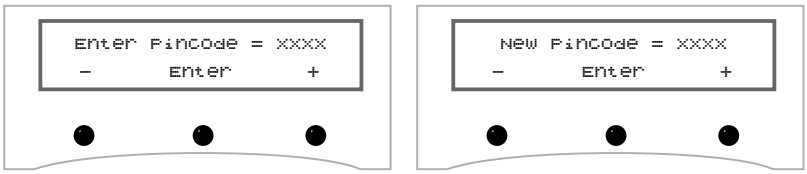
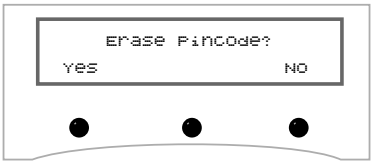


Figure 3-7
PIN Code Screens

To reset the PIN to four zeros (0000), press and hold the middle key during power-up until the Erase Pin Code screen pictured in Figure 3-8 appears.

Figure 3-8
Erase PIN Code Screen



3.2.4 The RETURN and CANCEL Keys

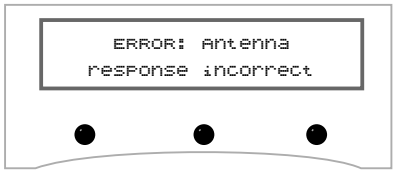
Throughout the GyroTrac menus, the right-hand key will often be designated as either RETURN or CANCEL. These options have the following functions:

- **RETURN** – Returns to the main data display. If no keys are pressed within 10 seconds, the menu will automatically default to the main data display.
- **CANCEL** – Cancels current action and returns to the start of the action without making any changes.

3.2.5 Antenna Error Messages

At times, the ADCU will display error messages alerting you to a specific problem (e.g., you have selected an invalid satellite pair). There are also two general antenna error messages that are not related to a specific action.

Figure 3-9
Incorrect Response Error Message



"Antenna Response Incorrect" (pictured in Figure 3-9) indicates that the ADCU received an incorrect answer from the antenna in response to a request. The solution to this error is simply to carry out your requested operation again.

Figure 3-10
Non-responsive Antenna Error Message

"Antenna not Responding" (pictured in Figure 3-10) indicates that no messages are being received from the antenna. This is usually the result of the antenna not being powered up or the antenna being unplugged from the ADCU.

3.3 Setup Display Mode

The Setup Display mode selects the data that will be displayed on the ADCU LCD after startup and self-test; it does not control the data sent to remote heading display units, north-up radars, autopilots, etc.

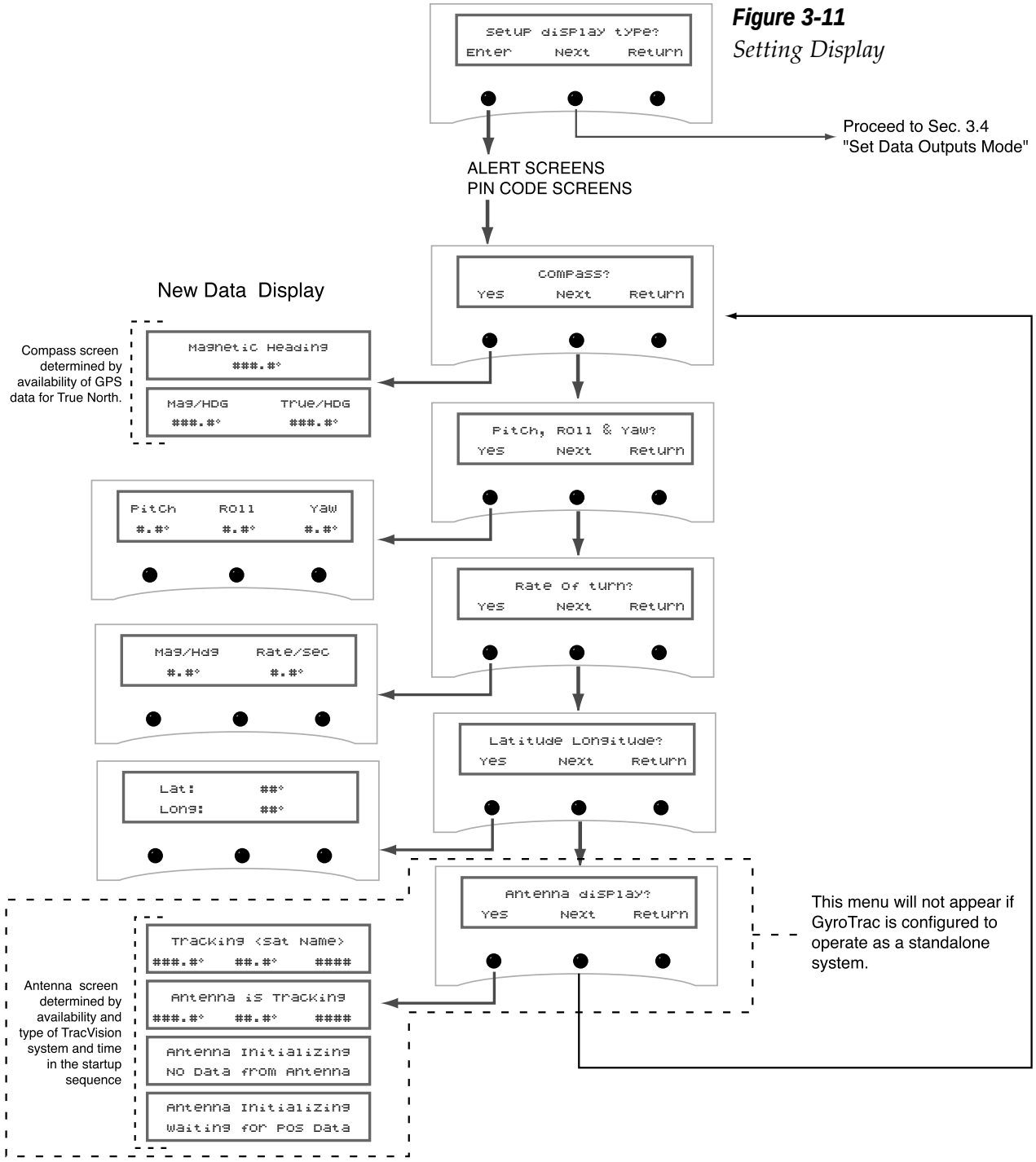


Figure 3-11
Setting Display

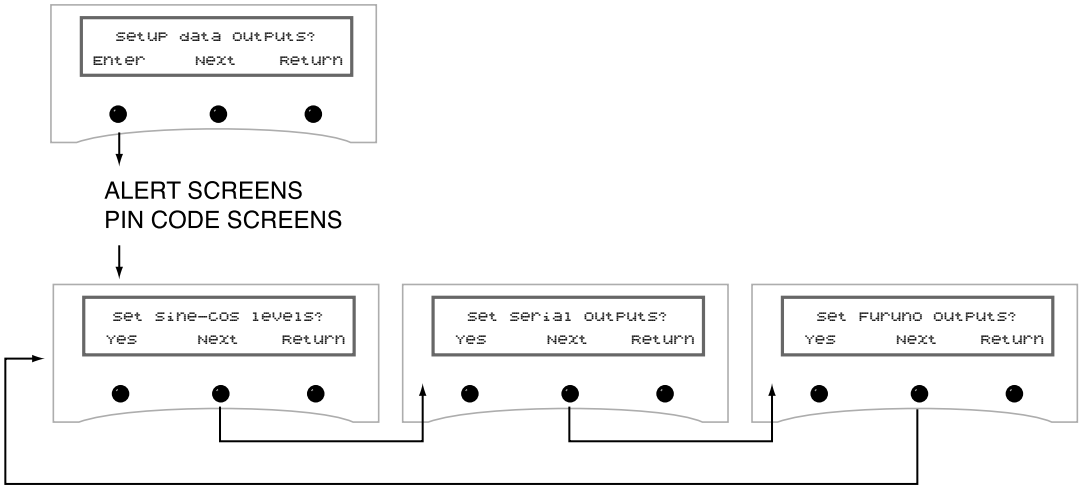
3.4 Set Data Outputs Mode

The Set Data Outputs function is used to select several types of data formats available in the GyroTrac. The message formats are:

- 1 Sine/cosine (either 3-wire or B&G 4-wire)
- 3 serial message formats:
  - NMEA 0183
  - KVH pitch, roll, and yaw, and
  - Cetrek
- 1 Furuno AD10S

These messages are output to displays and external navigation systems only if selected at the User Interface. Selection procedures are presented in the following sections.

Figure 3-12
Data Outputs Mode Menu Sequence



3.4.1 Setting the Sine/Cosine Data Output

The sine/cosine setup is done in three stages: first the magnetic or true heading option is selected, then the reference voltage is set, and finally the swing voltage is set. The valid range for reference and swing voltages is between 0 and 6.5 volts. The default values for reference and swing voltages are 5.0 volts. Refer to your autopilot manual for correct voltage requirements.

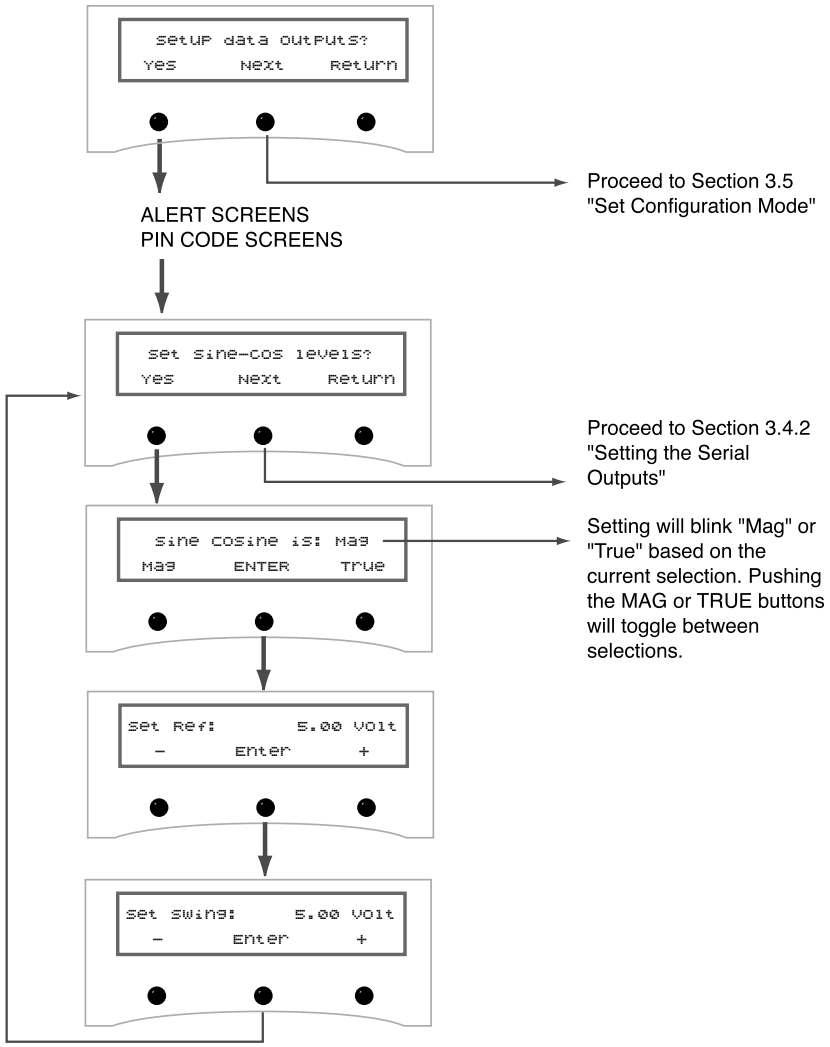
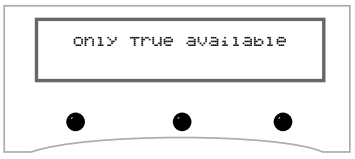
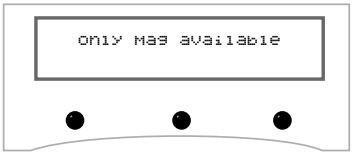


Figure 3-13
Setting Sine/Cosine Data Output

If the GyroTrac is receiving data from a ship's gyro, all compass outputs are automatically configured as True North and cannot be set as Magnetic. If this is the case, the following variation on the magnetic/true selection screen will be displayed:



If the system is NOT connected to a GPS or a ship's gyro, only magnetic heading data will be available and the following variation on the magnetic/true selection screen will be displayed:

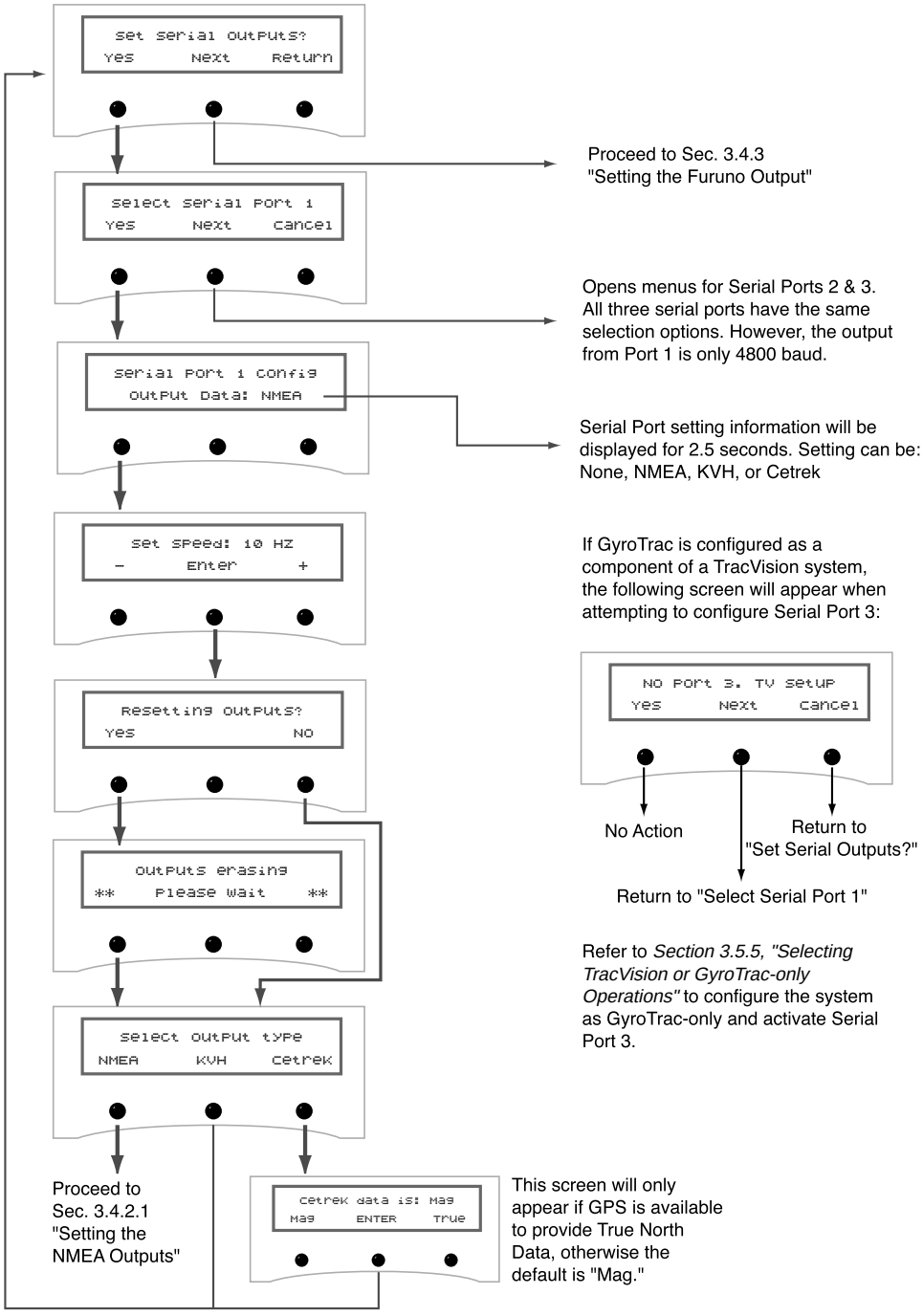


The system will then proceed to the "Set Ref" screens.

3.4.2 Setting the Serial Outputs

The GyroTrac can output up to three serial messages simultaneously in any combination of NMEA version 2.2, KVH RS-422, or Cetrek proprietary format. NMEA message options and the KVH and Cetrek formats are described briefly in *Appendix C.* Follow the procedures illustrated below to set the serial outputs. The factory default speed setting is 10 Hz.

Figure 3-14
Setting Serial Outputs

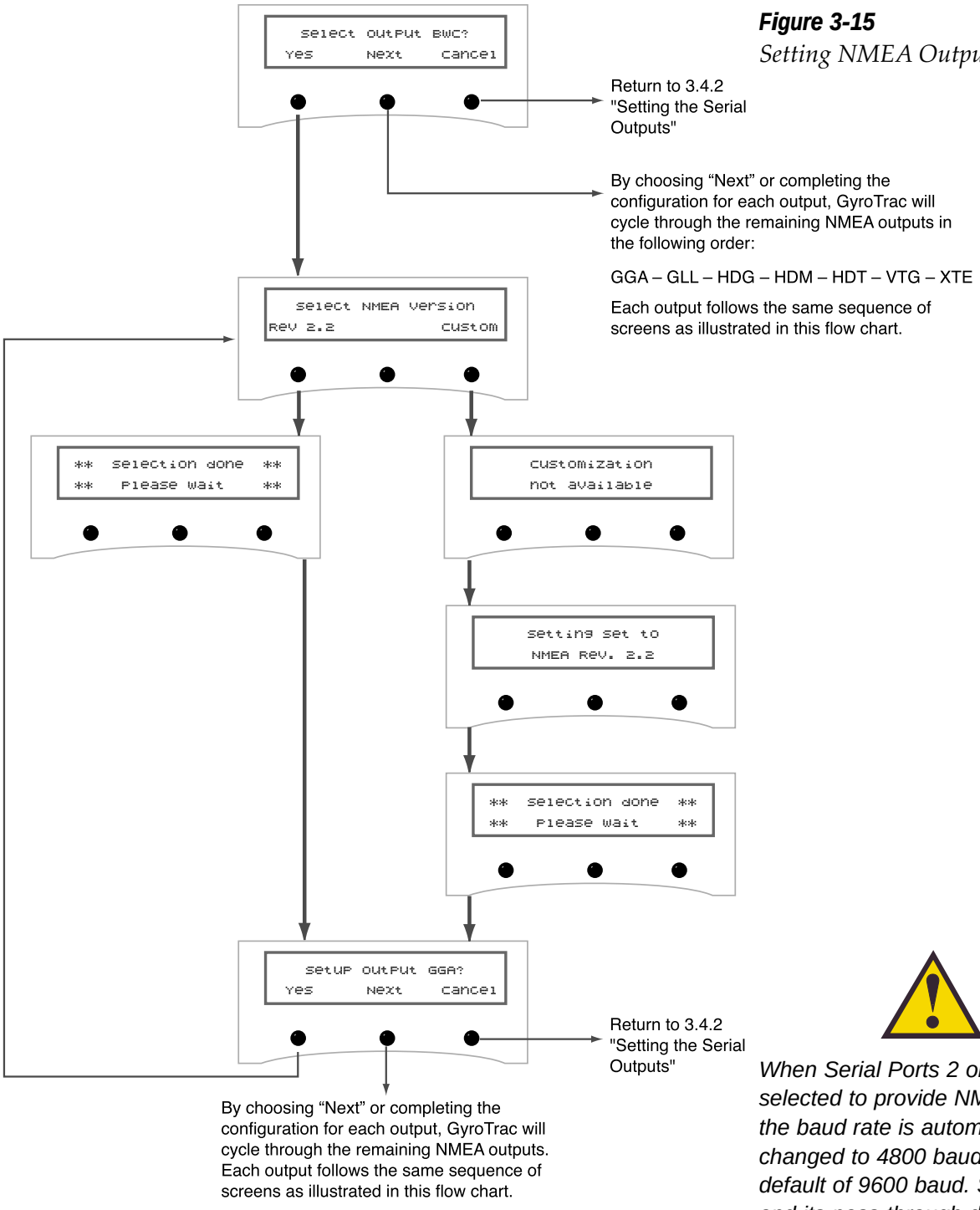

Set serial outputs?
Yes Next Return
Proceed to Sec. 3.4.3
"Setting the Furuno Output"
Select serial port 1
Yes Next Cancel
Opens menus for Serial Ports 2 & 3.
All three serial ports have the same selection options. However, the output from Port 1 is only 4800 baud.
Serial port 1 config
Output Data: NMEA
Serial Port setting information will be displayed for 2.5 seconds. Setting can be: None, NMEA, KVH, or Cetrek
Set speed: 10 HZ
- Enter +
If GyroTrac is configured as a component of a TracVision system, the following screen will appear when attempting to configure Serial Port 3:
Resetting outputs?
Yes NO
No Port 3. TV setup
Yes Next Cancel
No Action
Return to "Set Serial Outputs?"
Return to "Select Serial Port 1"
Outputs erasing
** Please Wait **
Refer to *Section 3.5.5, "Selecting TracVision or GyroTrac-only Operations"* to configure the system as GyroTrac-only and activate Serial Port 3.
Select output type
NMEA KVH Cetrek
Proceed to Sec. 3.4.2.1 "Setting the NMEA Outputs"
Cetrek data is: Mag
Mag ENTER True
This screen will only appear if GPS is available to provide True North Data, otherwise the default is "Mag."

3.4.2.1 Setting the NMEA Outputs

GyroTrac is fully compatible with NMEA *input* versions 1.5 and 2.2. However, the individual serial ports can only be programmed to use NMEA version 2.2 as an *output*.

Custom configurations are not available on GyroTrac at this time.

Figure 3-15
Setting NMEA Outputs

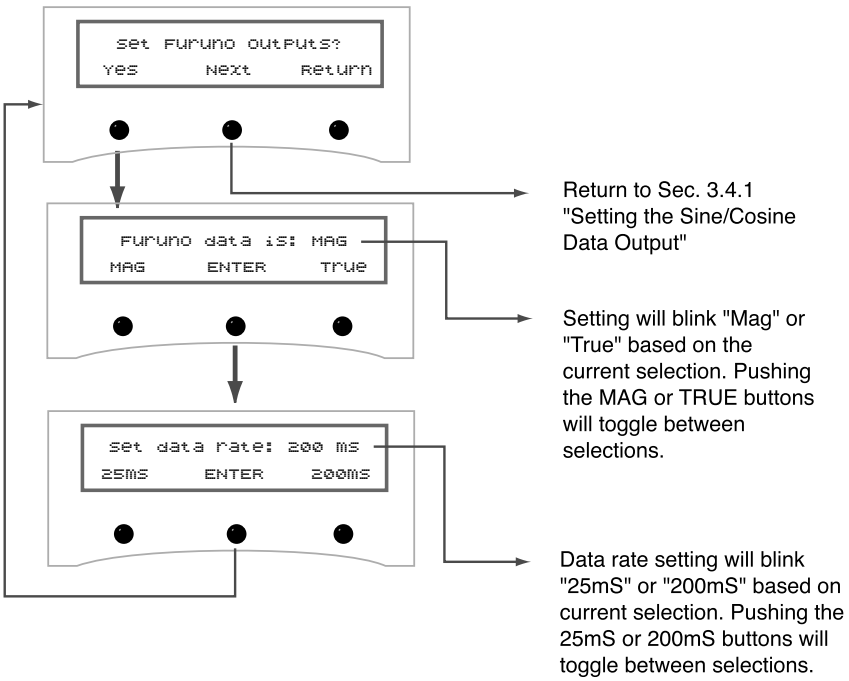

select output BWC?
Yes Next Cancel
Return to 3.4.2 "Setting the Serial Outputs"
By choosing “Next” or completing the configuration for each output, GyroTrac will cycle through the remaining NMEA outputs in the following order:
GGA – GLL – HDG – HDM – HDT – VTG – XTE
Each output follows the same sequence of screens as illustrated in this flow chart.
select NMEA version
Rev 2.2 Custom
** selection done **
** Please Wait **
customization
not available
setting set to
NMEA Rev. 2.2
** selection done **
** Please Wait **
setup output GGA?
Yes Next Cancel
Return to 3.4.2 "Setting the Serial Outputs"
By choosing “Next” or completing the configuration for each output, GyroTrac will cycle through the remaining NMEA outputs. Each output follows the same sequence of screens as illustrated in this flow chart.

When Serial Ports 2 or 3 are selected to provide NMEA output, the baud rate is automatically changed to 4800 baud from the default of 9600 baud. Serial Port 1 and its pass-through duplicate only provide 4800 baud output.

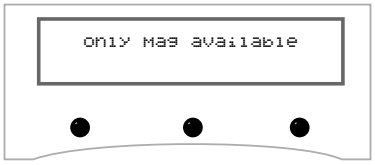
3.4.3 Setting the Furuno Output

This option selects two available options for the Furuno output: magnetic or true heading reference and 25 millisecond or 200 millisecond data output rate.

Figure 3-16
Setting Furuno Output


Set Furuno Outputs?
Yes Next Return
Furuno data is: MAG
MAG ENTER True
Set data rate: 200 ms
25ms ENTER 200ms
Return to Sec. 3.4.1 "Setting the Sine/Cosine Data Output"
Setting will blink "Mag" or "True" based on the current selection. Pushing the MAG or TRUE buttons will toggle between selections.
Data rate setting will blink "25mS" or "200mS" based on current selection. Pushing the 25mS or 200mS buttons will toggle between selections.

If the system is NOT connected to a GPS or a ship's gyro, only magnetic heading data will be available and the following variation on the magnetic/true selection screen will be displayed:



The system will then proceed to the "Set Data Rate" screen.

3.5 Set Configuration Mode

The Set Configuration function is used to select an internal or external source for heading data, enter offset values that correct for mechanical mounting alignment errors, reset the system to its factory defaults, and turn TV communications on/off.

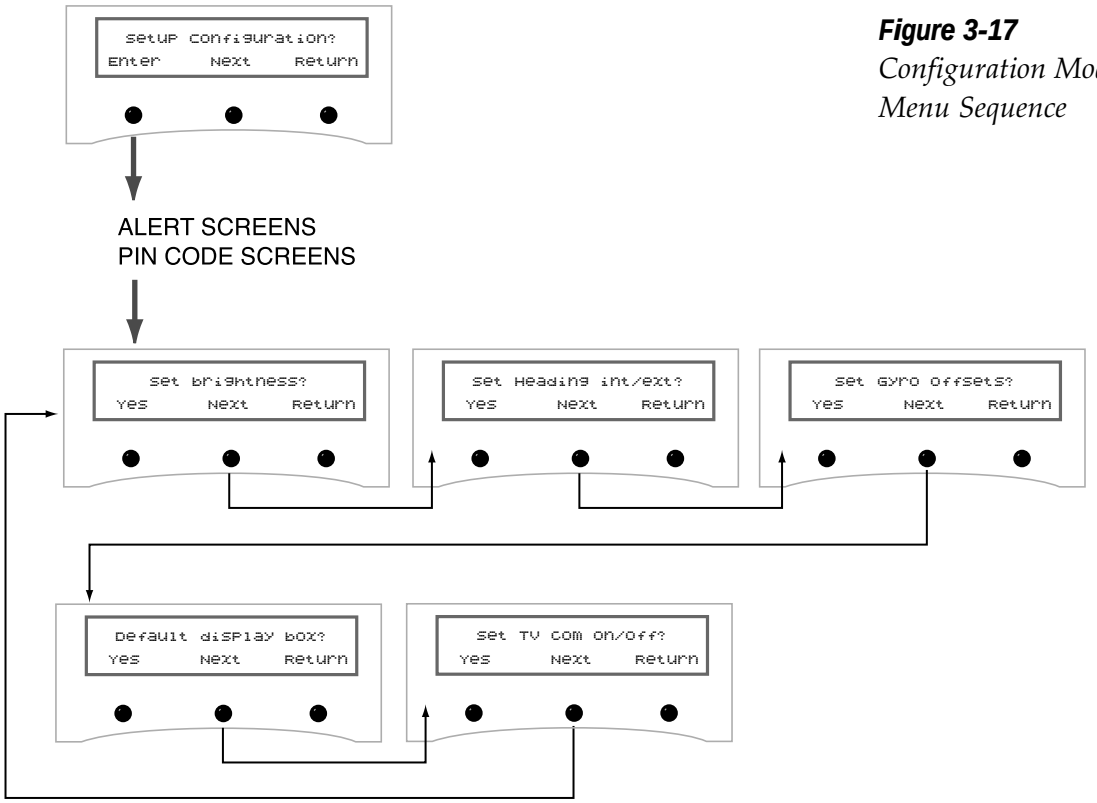
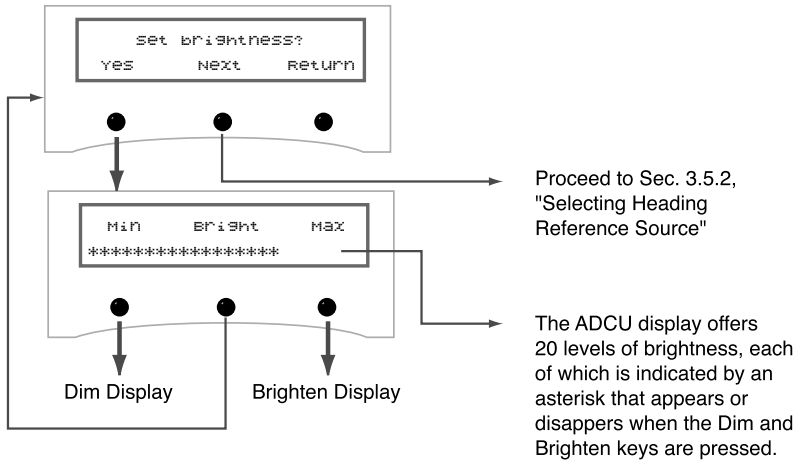


Figure 3-17
Configuration Mode Menu Sequence

3.5.1 Setting Display Brightness

The ADCU display's brightness may be adjusted to suit your preferences. Press the right key to make the display brighter, the left key to make it dimmer. When you are satisfied with the setting, press the center key to accept the setting.

Figure 3-18
Display Brightness Controls

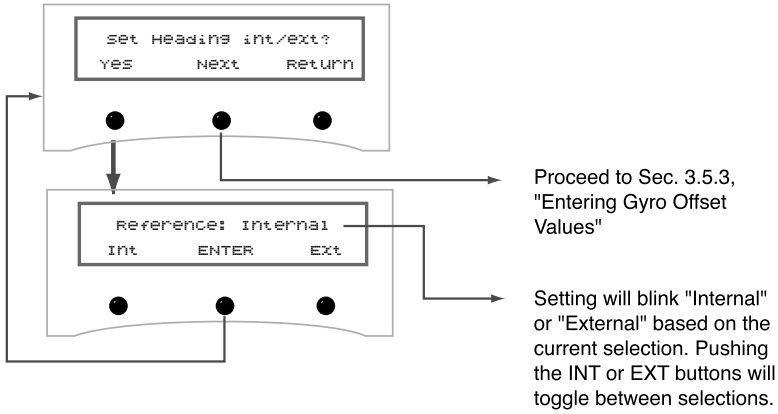

Set brightness?
Yes Next Return
Min Bright Max
****
Dim Display
Brighten Display
Proceed to Sec. 3.5.2, "Selecting Heading Reference Source"
The ADCU display offers 20 levels of brightness, each of which is indicated by an asterisk that appears or disappers when the Dim and Brighten keys are pressed.

3.5.2 Selecting Heading Reference Source

The Heading Reference Source menu provides the option to override the GyroTrac's external sensor module in favor of another source, such as a ship's gyro, as follows:

- **INTERNAL** – GyroTrac will receive and use heading data from its sensor module. In addition, the Control Compass menus will be available.
- **EXTERNAL** – GyroTrac will receive and use heading data from an external heading source. As a result, the Control Compass menus will be inactive and hidden. Refer to Figure 2-18 for details on connecting a ship's gyro to the ADCU.

Figure 3-19
Internal/External Reference Menus


Set Heading int/ext?
Yes Next Return
Reference: Internal
Int ENTER Ext
Proceed to Sec. 3.5.3, "Entering Gyro Offset Values"
Setting will blink "Internal" or "External" based on the current selection. Pushing the INT or EXT buttons will toggle between selections.

3.5.3 Entering Gyro Offset Values

The sensor module housing must be mounted as close to level in pitch and roll as possible, with its long axis parallel to the vessel's centerline. Sometimes allowances must be made for the particular installation where pitch, roll and azimuth references cannot be met. The offset values adjust for this. The allowable offset values for pitch and roll are ±45˚; the offset for azimuth can be up to ±180˚. Once entered, offset values will not need to be changed unless the Sensor Module is relocated.

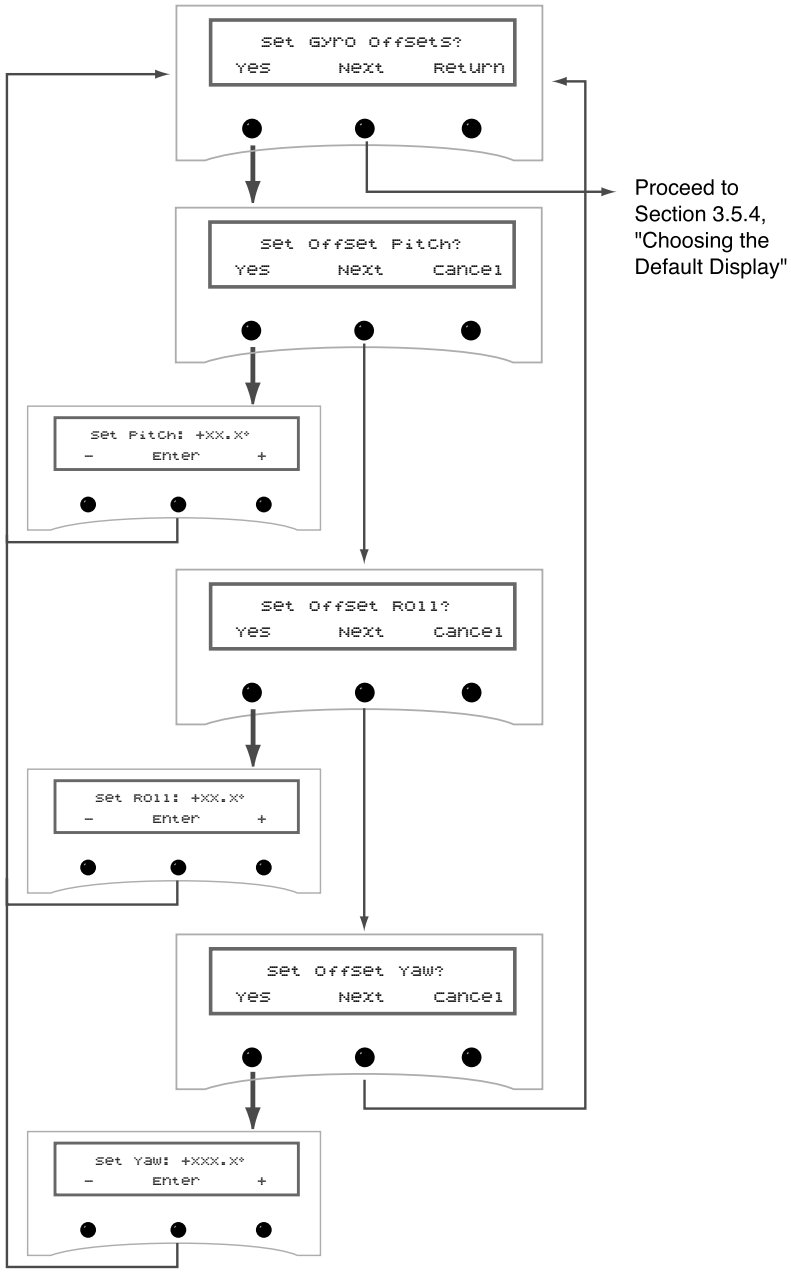


Figure 3-20
Entering Gyro Offset Values

Pitch, roll, and yaw settings are determined by the Sensor Module's internal inclinometer, not external measurements.

To set pitch, roll, and yaw properly, initially enter zeros for all measurements. Choose the Pitch, Roll, and Yaw display from the Main Menu and record those numbers.

Reverse the value of the Pitch and Roll (positive becomes negative, negative becomes positive).

Return to the Gyro Offset menu and enter the recorded numbers.

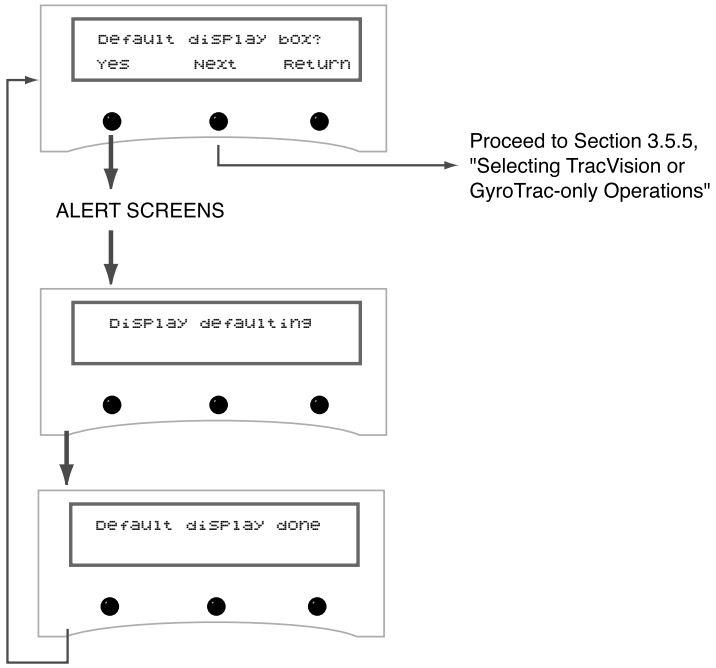
This process should be carried out in still water or at the dock.

As noted in Section 2.2, "Mounting the Sensor Module," *the sensor must be aligned to within ±5˚ of the vessel's fore-and-aft centerline. Deviation beyond ±5˚ will degrade pitch, roll, and yaw accuracy.*

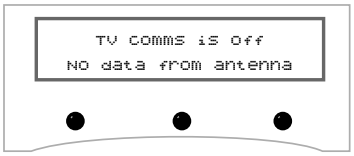
3.5.4 Choosing the Default Display

This option resets the ADCU display settings to their factory defaults.

Figure 3-21
Selecting the Default Display



If the main display is set to show antenna tracking information but the antenna communications are OFF, the following display will be shown:

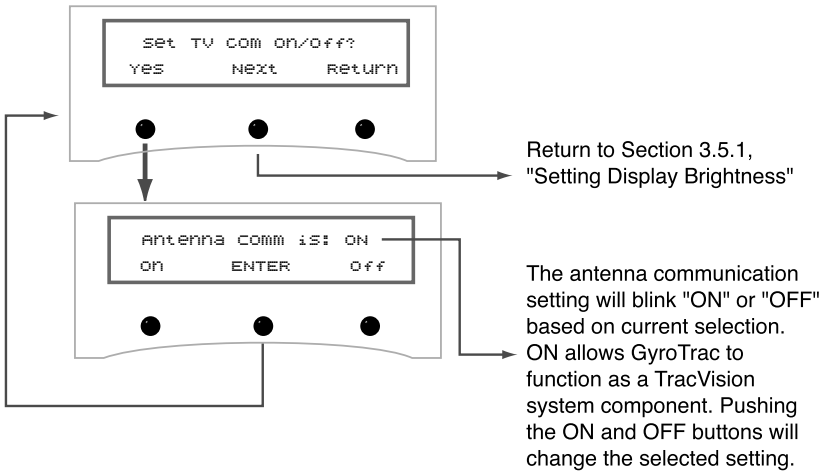


To correct the error, turn antenna communications ON or change the main display setting.

3.5.5 Selecting TracVision or GyroTrac-only Operations

GyroTrac's factory default configuration is to operate as a standalone system **(Antenna Comm is: OFF).** Connecting a TracVision antenna will reconfigure GyroTrac to function as a component of a TracVision system **(Antenna Comm is: ON)**.

Figure 3-22
Selecting TracVision- or GyroTrac-only Operations


Set TV com on/off?
Yes Next Return
Return to Section 3.5.1, "Setting Display Brightness"
Antenna comm is: ON
On ENTER Off
The antenna communication setting will blink "ON" or "OFF" based on current selection. ON allows GyroTrac to function as a TracVision system component. Pushing the ON and OFF buttons will change the selected setting.

3.6 Control Compass Mode

These screens are only seen if heading reference is INTERNAL.

The Compass Control function provides control over the GyroTrac sensor module, including turning autocalibration on and off, reading the calibration score, and manually clearing the compass calibration.

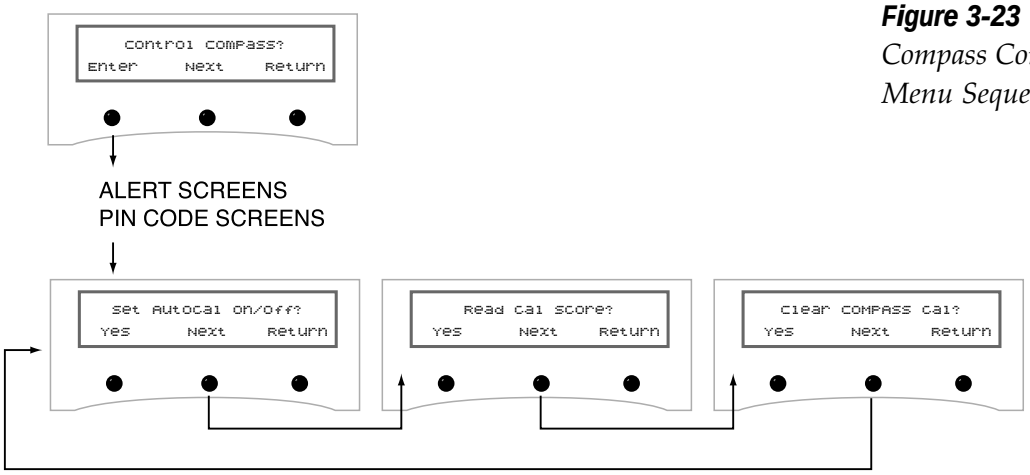


Figure 3-23
Compass Control Mode Menu Sequence

3.6.1 Selecting Autocompensation

These screens are only seen if heading reference is INTERNAL.

GyroTrac is fully capable of autocompensation to ensure that the navigation data is as accurate as possible.

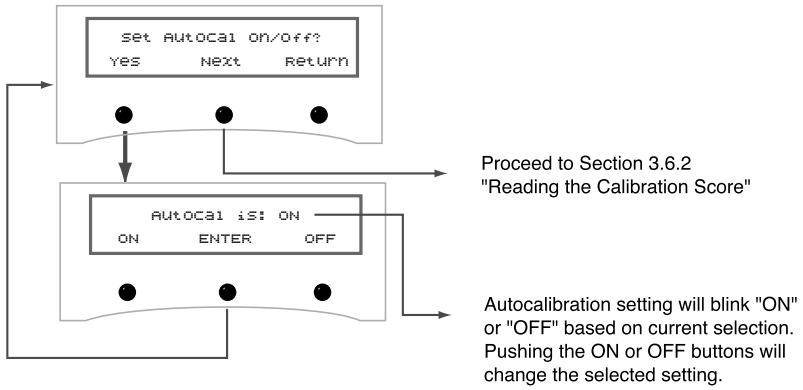

Set Autocal On/Off?
Yes Next Return
Autocal is: ON
ON ENTER OFF
Proceed to Section 3.6.2
"Reading the Calibration Score"
Autocalibration setting will blink "ON" or "OFF" based on current selection. Pushing the ON or OFF buttons will change the selected setting.

Figure 3-24
Setting Autocompensation

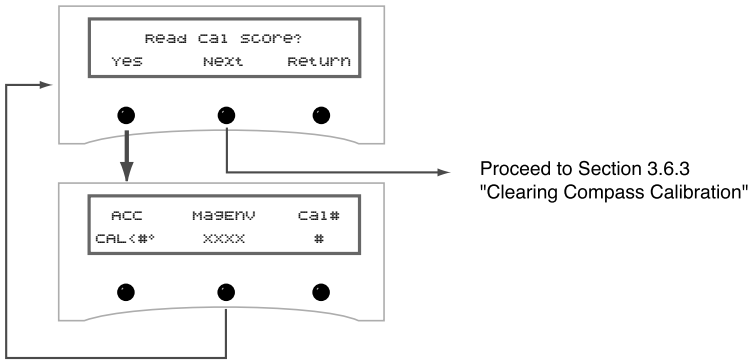
As noted in Section 2.6, "Calibrating the Sensor Module," *a well-calibrated sensor is crucial to GyroTrac's accuracy. If you shift, remove, or add equipment near the sensor, KVH suggests turning autocompensation on so that the sensor will automatically recalibrate itself within the surrounding magnetic field.*

3.6.2 Reading the Calibration Score

These screens are only seen if heading reference is INTERNAL.

The calibration score should be checked during the installation process and whenever adjustments are made to vessel equipment that can affect the compass' accuracy. A complete explanation of the compass calibration score has been provided in *Section 2.6.2, "The Calibration Score."*

Figure 3-25
Reading the Calibration Score

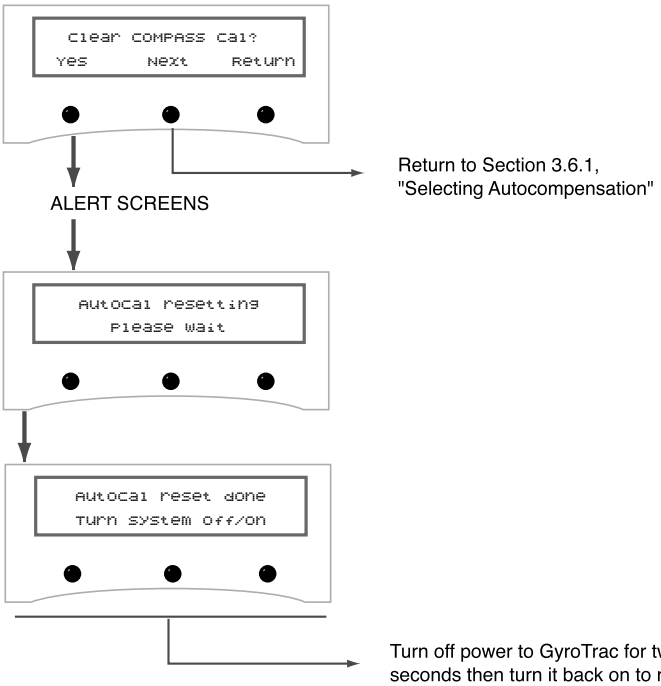


3.6.3 Clearing Compass Calibration

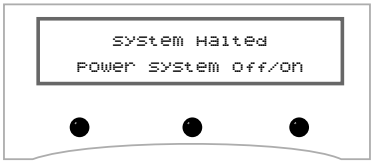
These screens are only seen if heading reference is INTERNAL.

Clearing the compass calibration will reset the system to the factory defaults.

Figure 3-26
Clearing Compass Calibration



After resetting this autocalibration, the following screen may appear:



This may result from a temporary lack of communication with the compass. Restart the system to restore compass data.

3.7 Antenna Status Mode

These screens are only seen if *Antenna Comm* is turned ON.

This sequence of steps allows a user to scan for system errors, access antenna type, version, and serial number information, check the signal and noise levels, indicate the skew angle, and display the bit error rate.

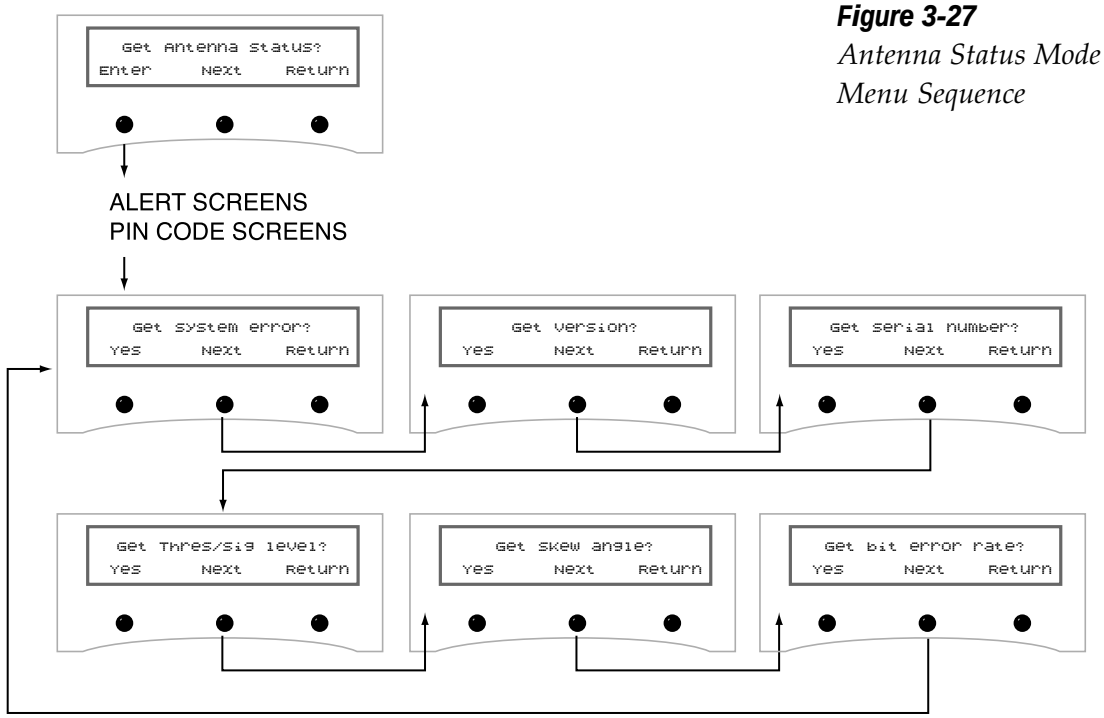


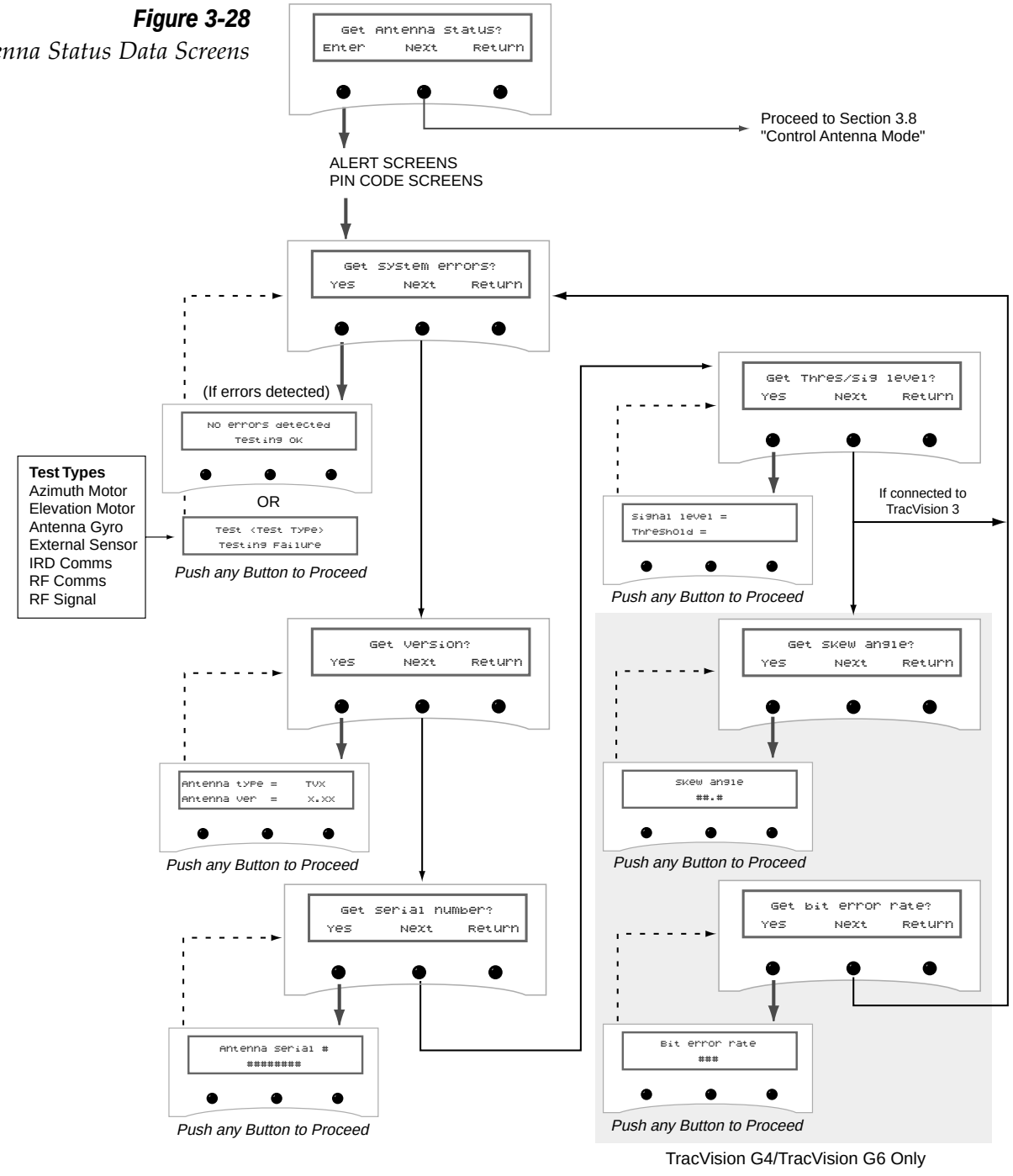
Figure 3-27
Antenna Status Mode Menu Sequence

3.7.1 Antenna Status Data Screens

These screens are only seen if *Antenna Comm* is turned ON.

Figure 3-28 illustrates the information available through the Get Antenna Status mode. The Skew Angle and Bit Error rates are only available when the GyroTrac ADCU is connected to a TracVision G4 or TracVision G6.

Figure 3-28
Antenna Status Data Screens



3.8 Control Antenna Mode

These screens are only seen if *Antenna Comm* is turned ON.

This sequence of steps allows a user to adjust the antenna's azimuth and elevation manually, restart the antenna, set Sleep Mode on or off, set Instant On Mode on or off, install a new pair of active satellites, set the latitude and longitude, and select the active satellite system.

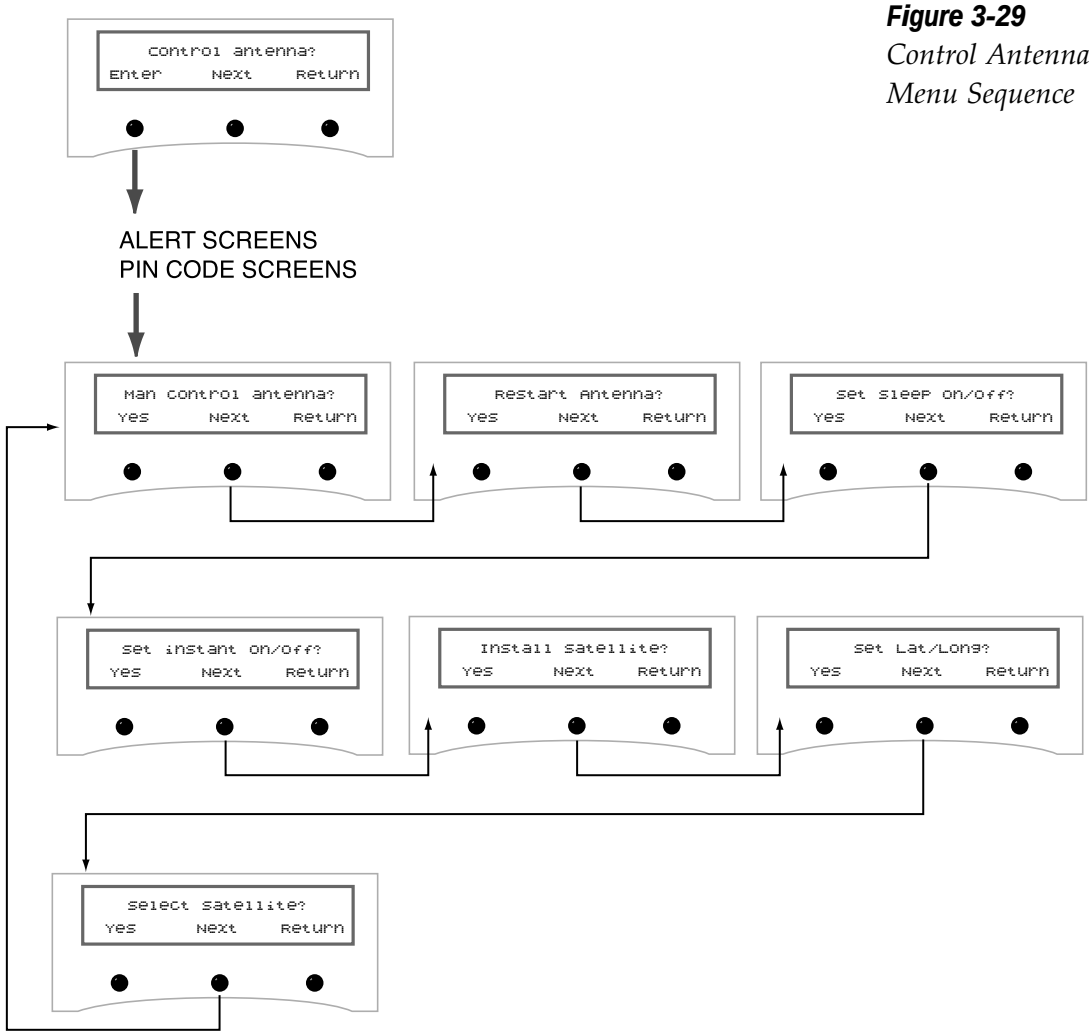


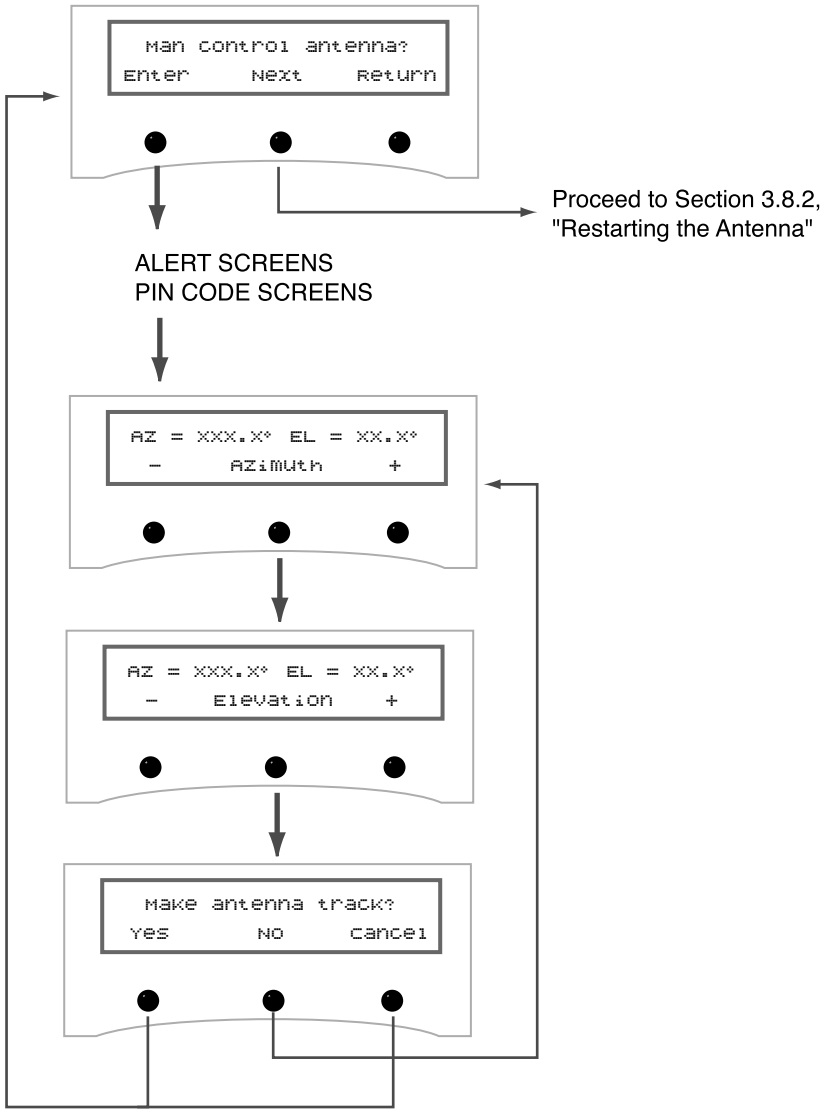
Figure 3-29
Control Antenna Mode Menu Sequence

3.8.1 Manually Controlling the Antenna

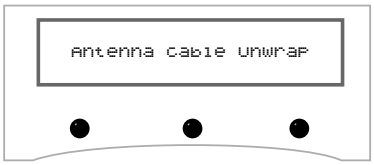
These screens are only seen if *Antenna Comm* is turned ON.

In certain circumstances, it may be necessary to control the azimuth, elevation, and tracking of the TracVision G4 or TracVision G6 antenna manually, using the process illustrated in Figure 3-30. Use +/- to manually move the dish. Azimuth measurements are reported as relative to the bearing of the vessel's bow.

Figure 3-30
Manual Antenna Control Procedure



If the manual adjustment of the antenna reached the maximum rotation (720°), the screen will display:



While this is displayed, the antenna will rotate 360° and return to the Manual Antenna Control screens.

YES tells the antenna to begin actively tracking the set azimuth and elevation. NO leaves the antenna halted in its current position.

3.8.2 Restarting the Antenna

These screens are only seen if *Antenna Comm* is turned ON.

After resetting satellite parameters, it is necessary to restart the antenna before the new settings take effect.

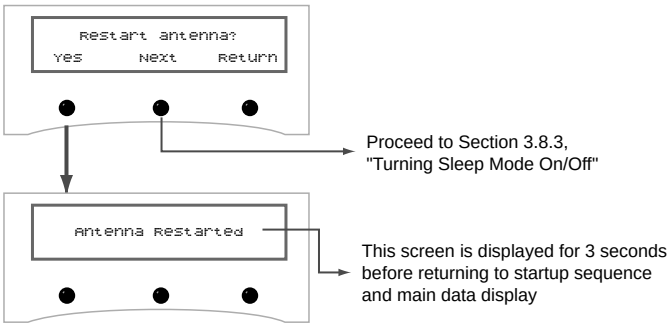


Figure 3-31
Restart Antenna Menu

3.8.3 Turning Sleep Mode On/Off

These screens are only seen if the GyroTrac ADCU is connected to a GyroTrac-compatible TracVision system.

Only the following systems include the Sleep Mode function:

- TracVision G6
- TracVision G4 - Antenna Software Version 3.02 or later
- TracVision 3 - Antenna Software Version 4.20 or later

To find your system's version number, use the Get Version function. Refer to Section 3.7.1, "Antenna Status Data Screens."

Sleep Mode turns off conical scan tracking if the antenna holds the same position for 1 minute. As soon as the vessel moves, the system will automatically begin tracking the satellite again.

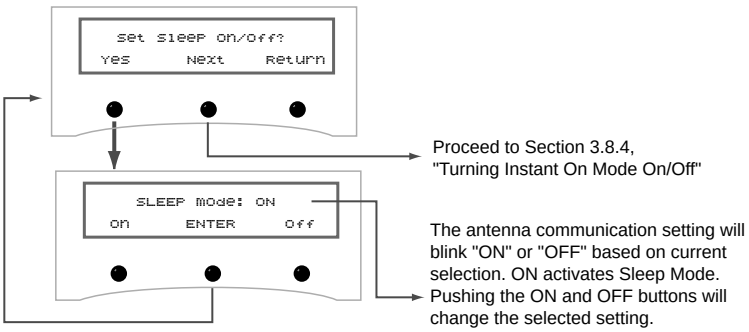

Set sleep On/Off?
Yes Next Return
Proceed to Section 3.8.4,
"Turning Instant On Mode On/Off"
SLEEP Mode: ON
On ENTER Off
The antenna communication setting will
blink "ON" or "OFF" based on current
selection. ON activates Sleep Mode.
Pushing the ON and OFF buttons will
change the selected setting.

Figure 3-32
Sleep Mode Menu

As its factory default setting, Sleep Mode is turned ON.

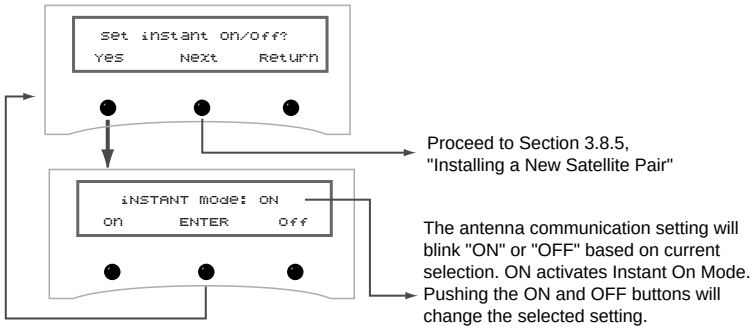
3.8.4 Turning Instant On Mode On/Off

These screens are only seen if the GyroTrac ADCU is connected to a TracVision G4 (antenna software version 3.27 or later) or a TracVision G6.

Instant On allows the antenna to immediately receive a TV signal if the vessel has not moved since the antenna was last shut off. If the vessel moves after acquiring the satellite via Instant On, the antenna will undergo its standard initialization process, resulting in a brief interruption of the TV signal.

To find your system's version number, use the Get Version function. Refer to Section 3.7.1, "Antenna Status Data Screens."

Figure 3-33
Instant On Mode Menu


Set instant on/off?
Yes Next Return
Proceed to Section 3.8.5, "Installing a New Satellite Pair"
iNSTANT Mode: ON
On ENTER Off
The antenna communication setting will blink "ON" or "OFF" based on current selection. ON activates Instant On Mode. Pushing the ON and OFF buttons will change the selected setting.

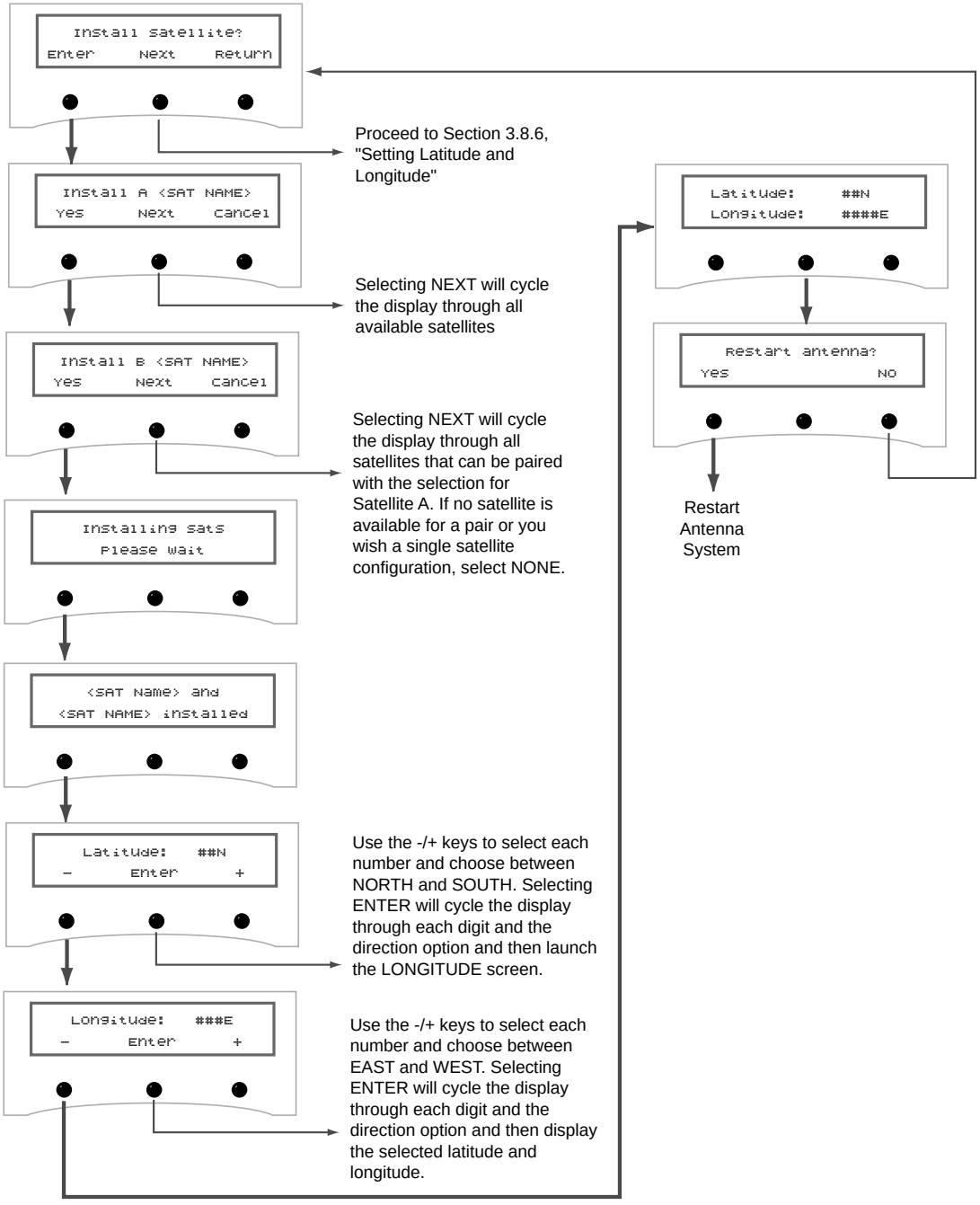
As its factory default setting, Instant On Mode is turned ON.

3.8.5 Installing a New Satellite Pair

These screens are only seen if the GyroTrac ADCU is connected to a TracVision G4 or TracVision G6.

TracVision G4 and TracVision G6 permit two satellite services (Satellites A and B) installed simultaneously. There is also an option for **NONE** on satellite B, permitting single satellite operation.

Figure 3-34
Installing Satellite Pair Process

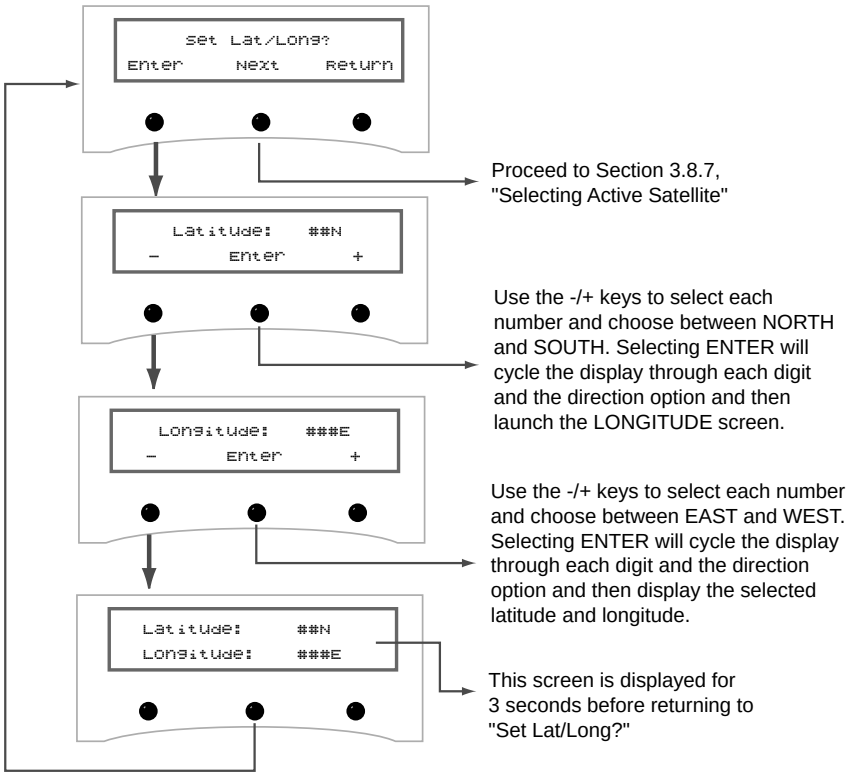

Install Satellite?
Enter Next Return
Proceed to Section 3.8.6, "Setting Latitude and Longitude"
Install A <SAT NAME>
Yes Next Cancel
Selecting NEXT will cycle the display through all available satellites
Install B <SAT NAME>
Yes Next Cancel
Selecting NEXT will cycle the display through all satellites that can be paired with the selection for Satellite A. If no satellite is available for a pair or you wish a single satellite configuration, select NONE.
Installing Sats
Please Wait
<SAT Name> and
<SAT NAME> installed
Latitude: ##N
– Enter +
Use the -/+ keys to select each number and choose between NORTH and SOUTH. Selecting ENTER will cycle the display through each digit and the direction option and then launch the LONGITUDE screen.
Longitude: ###E
– Enter +
Use the -/+ keys to select each number and choose between EAST and WEST. Selecting ENTER will cycle the display through each digit and the direction option and then display the selected latitude and longitude.
Latitude: ##N
Longitude: ####E
Restart antenna?
Yes NO
Restart Antenna System

3.8.6 Setting Latitude and Longitude

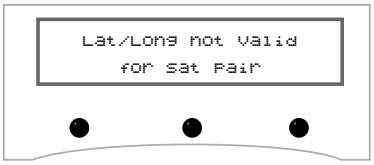
These screens are only seen if the GyroTrac ADCU is connected to a TracVision G4 or TracVision G6.

When installing a satellite pair, it is also necessary to enter the vessel's latitude and longitude to ensure that the installed satellites are viewable as well as to permit the system to set several internal parameters.

Figure 3-35
Set Latitude/Longitude Procedure


Set Lat/Long?
Enter Next Return
Proceed to Section 3.8.7, "Selecting Active Satellite"
Latitude: ##N
– Enter +
Use the -/+ keys to select each number and choose between NORTH and SOUTH. Selecting ENTER will cycle the display through each digit and the direction option and then launch the LONGITUDE screen.
Longitude: ###E
– Enter +
Use the -/+ keys to select each number and choose between EAST and WEST. Selecting ENTER will cycle the display through each digit and the direction option and then display the selected latitude and longitude.
Latitude: ##N
Longitude: ###E
This screen is displayed for 3 seconds before returning to "Set Lat/Long?"

If the latitude and/or longitude entered is not valid for the installed satellite pair, the following screen will appear:



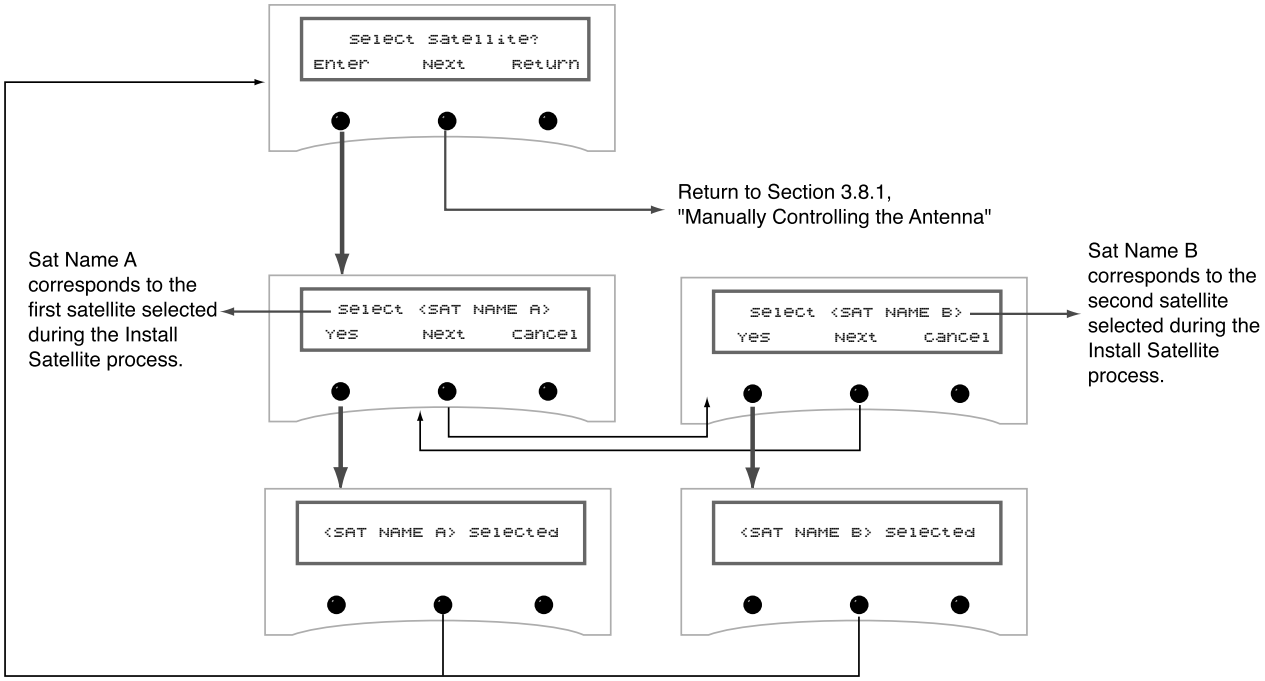
Recheck and re-enter your latitude and longitude and verify your installed satellite pair to resolve this issue.

3.8.7 Selecting Active Satellite

These screens are only seen if the GyroTrac ADCU is connected to a TracVision G4 or TracVision G6.

After installing the active pair of satellites, use the Select Satellite menu to choose which of the installed satellites will be active.

Figure 3-36
Select Active Satellite



4 Troubleshooting

The KVH GyroTrac is designed for reliable, easy use. This section provides a brief overview of some potential operational issues that may arise.

TracVision-specific issues are discussed in Section 4, "Troubleshooting," *of the appropriate TracVision manual.*

Issue 1:

System fails startup routine and ADCU displays "Errors Detected."

Solution:

GyroTrac will not operate unless the system passes the startup self-tests. The following actions may be taken in this instance.

- Shut down the system and restore power.
- Shut down the system and verify proper wiring and dip switch settings (if your ADCU is equipped with dip switches) as detailed in *Section 2.4, "Wiring the GyroTrac."*
- Contact a KVH dealer or distributor for further assistance.

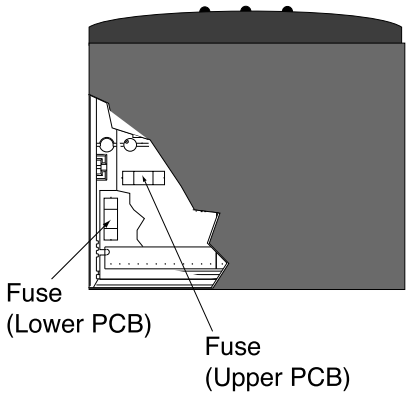
Issue 2:

System is installed correctly and power is available, but the system is non-functional.

Solution:

Check the 1-amp fuses within the ADCU. Remove the two screws securing the top and the base of the ADCU. Remove the top of the ADCU. The 1-amp fuses are secured in brackets on the upper and lower printed circuit boards (PCBs) within the unit. Remove the damaged fuse and replace with a new, functional 1-amp fuse.

Figure 4-1
ADCU Fuse Locations (Top CutAway)



Issue 3:

GyroTrac is connected to a GyroTrac-compatible TracVision system but there is no communication between GyroTrac and the antenna and you are unable to access antenna-specific menus on the ADCU.

Solution:

Verify that GyroTrac is configured as a TracVision component, as detailed in *Section 3.5.5, "Selecting TracVision or GyroTrac-only Operations."*

Issue 4:

There is no data output through Serial Port #3.

Solution:

Serial Port #3 provides no output when GyroTrac is configured as a component within a GyroTrac-compatible TracVision system. To make Serial Port #3 available for use with other onboard equipment, reconfigure the system as described in *Section 3.5.5, "Selecting TracVision or GyroTrac-only Operations,"* to function as a standalone unit, not as a part of a TracVision system.

5 Maintenance

5.1 Warranty/Service Information

KVH Industries, Inc. warrants the GyroTrac against defects in materials and workmanship for a period of two years and labor for a period of one year from the date of original retail purchase by the original purchaser. Labor is only warrantied if the GyroTrac was installed by an authorized KVH technical dealer. It is the customer's responsibility to verify the date of purchase by returning the warranty card included with the product to KVH within 30 days of purchase, or by providing a copy of a dated sales receipt for the KVH product under warranty with the warranty claim. If this date cannot be verified, the warranty period will begin 30 days after the date of manufacture of the original product purchased.

The GyroTrac serial number will be required for any maintenance or troubleshooting calls. It can be found in the front of this manual, on the Sensor Module end cap, and on the back of the ADCU.

For additional information on KVH warranty, repair, and liability policies, please refer to the complete warranty statement provided at the conclusion of this manual.

5.2 Replaceable Parts

GyroTrac has been designed with durability and low maintenance in mind. If you are experiencing an operating problem or otherwise require technical assistance, contact your local KVH dealer or distributor first. Have the GyroTrac serial number ready with a list of the trouble symptoms. If an authorized dealer or distributor is not located nearby, contact KVH directly at the telephone, facsimile, or e-mail listings inside the front cover.

Replacement parts for components that can be serviced in the field are listed in Table 5-1. These parts may be obtained from any KVH-authorized dealer/installer.

Table 5-1
Field Replaceable Units

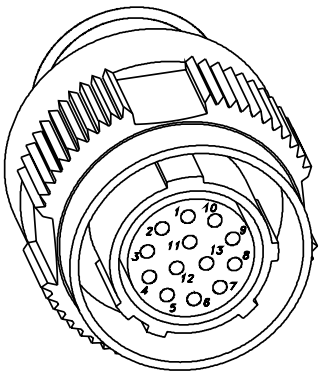
FRU	KVH Part No.
Sensor Module	02-0991
ADCU	02-0961
Flush Mount ADCU Panel	20-0667
Horizontal Sensor Bracket	20-0658
Vertical Sensor Bracket	20-0666
Connector Wire Terminal Strip	23-0223-12
Sensor to ADCU Data Cable	32-0623-30
ADCU Fuse	16-0009-1000

Table 5-2 and Figure 5-1 provide the pin assignments for the Sensor to ADCU Data Cable (Part Number 32-0623-30).

Table 5-2
Data Cable Wiring/Terminal Assignments

Connector Terminal	Wire Color	Function
1	Wht/Blu Stripe	FE_TXD+
2	Blu/Wht Stripe	FE_TXD-
3	Wht/Org Stripe	FE_RXD-
4	Org/Wht Stripe	FE_RXD+
10	Wht/Grn Stripe	GND
11	Grn/Wht Stripe	+12V
Shell	Shield	---

Figure 5-1
Data Cable Terminal Arrangement



Appendix A
System Specifications

The following table presents system specifications and operating parameters for the GyroTrac system.

Performance Data

Table A-1
System Performance

Accuracy	±3.0˚ peak; ±1.0˚ typical[1]
Repeatability	±0.25˚
Resolution	±0.1˚ (gyro ±0.01)
Tilt Angle/Pitch & Roll Range	±45˚
Rate Gyro Drift	0˚/minute (auto-corrected)
Maximum Angular Velocity	45˚/second
Bandwidth	10 Hz
Power/Consumption	12-32VDC/330 mA (stand-alone) *TracVision component: 11-16VDC* *3.5 amps nominal, 4.5 amps peak*
Data I/O Format	RS-422 (NMEA 0183 Version 2.2)
Zero Point Stability	±0.8˚

1. After calibration, free magnetic field to tilt angles of ±20˚; accuracy ±5.0 RMS to ±45˚ tilt or roll.

Environmental Data

Table A-2
Environmental Specifications

Operating Temperature	-25˚C to +55˚C (-13˚F to +130˚F)
Storage Temperature	-40˚C to +85˚C (-40˚F to +185˚F)
Maximum Shock (Performance)	20G, 11 msec
EMI/RFI	IEC 945; FCC Part 15J, Class B

Table A-3
Interface Assignments

Interface Data	
NMEA 0183 ver. 2.2:	
BWC	Bearing, distance to waypoint
GGA	GPS fix data
GLL	GPS latitude, longitude
HDG	Stabilized magnetic heading
HDM	Magnetic heading
HDT	True heading
VTG	Course over ground, speed over ground
XTE	Cross-track error (measured)
Cetrek	Proprietary digital output
Sine/Cosine	
3-wire	User-selectable reference/swing voltage
4-wire (B&G)	set reference voltage to 3.5v
Furuno	AD10S standard output

Appendix B
Optional KVH Displays

Three optional displays are available; each presents true or magnetic heading in a different way (see Figure B-1). The pointer analog display has a pointer rotating against a fixed 360˚ dial. The digital display presents heading numerically; it also displays the compass calibration score when this option is selected with the Setup Configuration function. The rotating card display has a compass card rotating under a fixed lubber line. The pointer analog and digital displays have five levels of user-selectable backlighting; the rotating card display has continuously variable red or green backlighting (the color is user-selectable).

Figure B-1
Display Options

B.1 Optional Display Specifications

Table B-1
Display Specifications

Pointer Analog Display

Dimensions	4.3" (110 mm) x 4.3" (110 mm) x 0.8" (20 mm)
Weight	7.5 oz (210 gm)

Digital Display

Dimensions	6.5" (165 mm) x 4.3" (110 mm) x 0.8" (20 mm)
Weight	13.4 oz (380 gm)

Card Analog Display

Dimensions	5.6" (142 mm) x 5.6" (142 mm) x 3" (76 mm)
Weight	39 oz (1110 gm)

B.2 Mounting the Pointer Analog and Digital Displays

The pointer analog and digital displays both include a pigtail cable coming from inside the display housing. The following mounting instructions are applicable to both display types. Ensure the mounting surface is flat and free of excessive vibration. Do not mount the display housing on a rigid curved surface, as tightening down the nuts on the threaded studs may bend the housing and damage the unit. Refer to Figure B-2.

1. Using the template packed with the unit, mark the centers of the threaded studs.
2. Center-punch and drill 2 holes using a 3/4-inch or 20 mm bit.
3. Feed the pigtail cable through the right hole, then insert the threaded studs.
4. Attach the lockwashers and nuts provided and tighten securely.

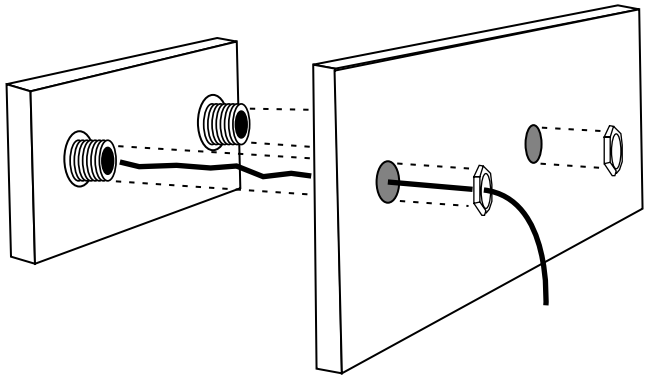


Figure B-2
Mounting the Analog/Digital Displays

B.2.1 Mounting the Display Backlighting Control

A backlighting control button is included with the pointer analog and digital display units. Figure B-3 illustrates the mounting procedure.

1. Select a location convenient to the display and drill a mounting hole using a 5/8-inch (16 mm) bit. The mounting area should be no thicker than 3/8-inch (10 mm).
2. Insert the button and secure it from the rear with the lockwasher and nut provided.

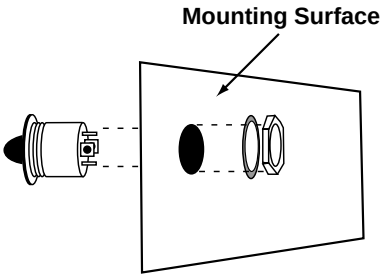


Figure B-3
Mounting the Display Backlighting Control Switch

B.2.2 Wiring the Pointer Analog and Digital Displays

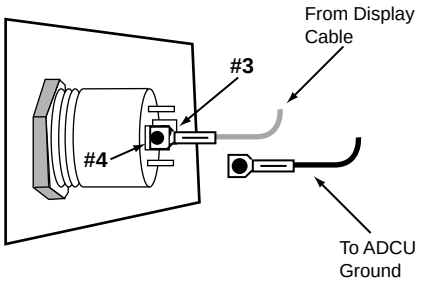
Table B-2 details the wiring designations for the pointer analog and digital displays, including the recommended ADCU terminal strip connectors.

Table B-2
Display Cable Connections

Wire Color	Signal Function	Recommended Terminal Connector
White	Lighting level	Backlight Control Button
Blue	RS-422 NMEA Data	TX1A(+) – #4
Green	RS-422 NMEA Ref	TXB(-) – #5
Red	12 Vdc positive	KVH Display Power – #3
Black	12 Vdc negative	Ground – #6
Shield/Drain	Ground	Ground – #6
Brown	Not Used	Not Connected

B.2.3 Wiring the Backlight Control Switch

Figure B-4
Wiring the Backlight Control Switch



1. Run a separate 2-conductor wire between the ADCU and the backlight control button.
2. Crimp terminal lugs to the two wires that will connect to the backlight control button.
3. Fasten the lugs to button terminals 3 and 4 (polarity does not matter) with nuts and lockwashers provided.
4. The other end of the 2-conductor wire will connect to the display cable and the ADCU as follows:
   - Splice one strand of the 2-conductor wire to the display cable's white wire.
   - Wire the other strand of the 2-conductor wire directly to the ADCU ground terminal.

B.3 Mounting the Rotating Card Display

The Rotating Card Display may be mounted either free standing on its bracket or flush with the panel. Templates for either method are found in Appendix E. The unit should be no closer than 36" (1 m) to any magnetic compass. Before installing, remove the display unit from its stand by removing the latch knobs on either side.

B.3.1 Bracket Mounting

1. Select a site with room for the unit to rotate in its bracket. Cut out or copy Template E-1 and tape in place. Mark and drill two 1/4" (6 mm) holes as indicated. Fasten the bracket in place with the screws provided.
2. Reattach the display unit to the bracket temporarily until ready to make the power and data connections described in *Section B.3.3, "Wiring the Rotating Card Display."*

B.3.2 Panel Mounting

1. Cut out or copy Template E-2 and mark lines for the cutout area. Cut away the material inside the lines and clean up to the lines with a file. Test-fit the display unit in the cutout opening.
2. Remove the two 6 mm machine screws from the back of the display unit. Insert the display unit into the cutout; place the panel mounting bracket clamp in position behind the display unit. Reverse the 6 mm screws and reinsert into the case through the bracket clamp. Tighten the screws securely.

B.3.3 Wiring the Rotating Card Display

1. Refer to Figure B-5. To remove the backplate, undo 8 screws (a) and withdraw the backplate assembly. Separate the two pigtail plug connectors from the card assembly.

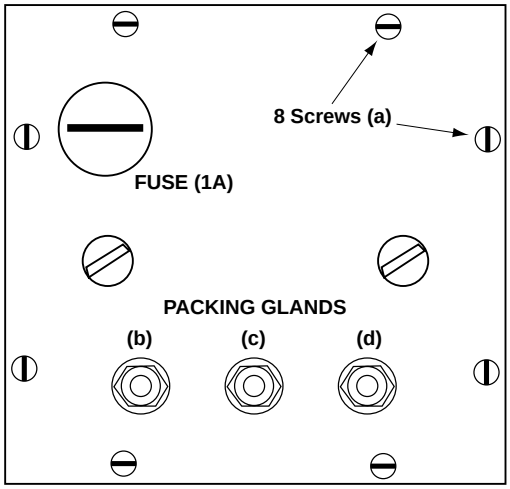


Figure B-5
Rotating Card Display – Removing the Backplate

2. Pass the power supply and data cables through their packing glands (b,c,d) from the outside and tighten the gland nuts before connecting wires.

3. Refer to Figure B-6 below; connect the power and data wires to the terminal block as listed in Table B-3.

Figure B-6
Rotating Card Display – Terminal Strip Wiring

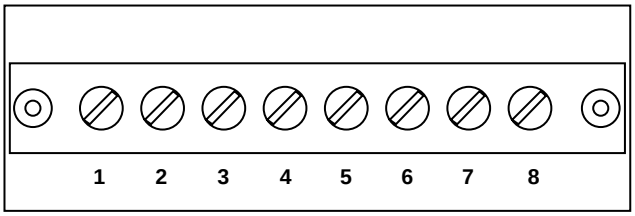
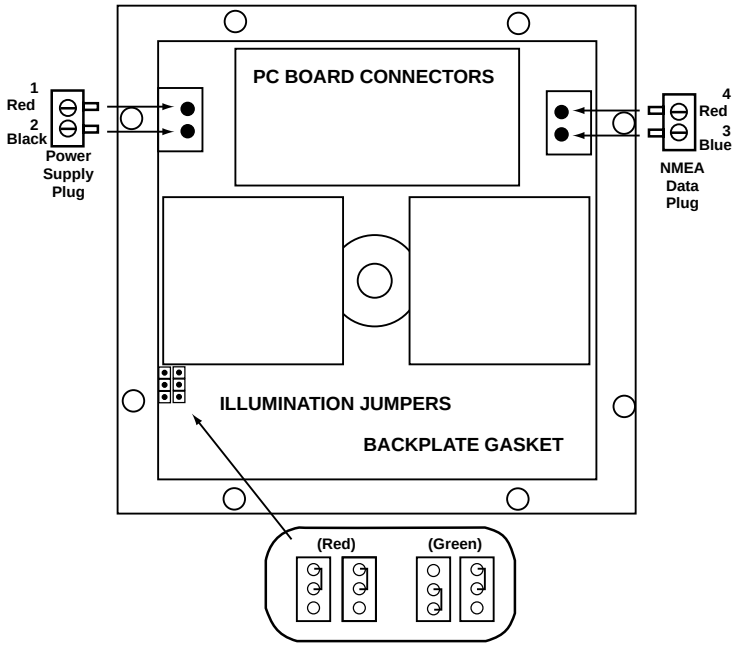


Table B-3
Rotating Card Display – Terminal Strip Wiring Details

Term. #	Function
1	Output B (linked to term. 5)
2	Output A (linked to term. 6)
3	Shield for output cable
4	Shield for input cable
5	Input B (NMEA 0183 data)
6	Input A (NMEA 0183 data)
7	11-40 Vdc NEG (-)
8	11-40 Vdc POS (+)

4. Set the jumpers as shown in Figure B-7 to select red or green night illumination.

Figure B-7
Rotating Card Display – PC Board Jumpers and Connectors



5. Check that the backplate gasket is in place; return the power and data pigtail plugs to their respective PC board connectors.
6. Arrange the internal wiring before replacing and tightening the backplate screws.

Appendix C
Data Outputs

The GyroTrac transmits up to five selectable message types simultaneously to external navigation devices connected to the User Interface. One output port is dedicated to the sine/cosine signal format, one is dedicated to the Furuno AD10S signal format, and three separate serial ports allow outputs of NMEA 0183, KVH RS-422, and Cetrek proprietary signal formats. Each of these message formats is described below. Step-by-step instructions for selecting desired message outputs is given in *Section 3, "Initialization and Configuration."*

C.1 Sine/Cosine Output

Refer to Section 2.4.4, Wiring the GyroTrac Sine/Cosine Interface, *for complete instructions on properly configuring GyroTrac and other navigational systems to use the sine/cosine output.*

GyroTrac may be configured to provide either 3-wire or 4-wire sine/cosine output, but not both. Sine/cosine output message options are magnetic or true heading and a combination of reference and swing voltages used to denote the heading value. The reference and swing voltages are set through the ADCU to suit the requirements of the device using the data. Default reference and swing voltages (as shipped) are 5.0 volts. The allowable range for reference and swing voltages is 0 to 6.5 volts in 0.01 volt increments. The sine/cosine output is commonly used in ComNav, Robertson, and other autopilots.

B&G 4-wire Sine/Cosine

The B&G 4-wire sine/cosine output (also known as "differential sine/cosine") is a substitution of the Halcyon® compass. The reference voltage should be set at 3.5V.

C.2 Serial Port Outputs

Serial ports #1, #2, and #3 may be individually programmed to output any of the message formats described below. Up to eight NMEA 0183 listening devices can be connected to each of the serial ports. Serial Port #1 also has a pass-through duplicate port. The NMEA message format conforms to NMEA 0183 version 2.20 standard for message structure. The KVH message format is an RS-422 message format giving stabilized pitch, roll and yaw data. Data output from Port 1 will be at 4800 baud while

data from Ports 2 and 3 will be at 9600 baud; this message may be used in any device capable of receiving this data rate. The Cetrek proprietary message format is a stabilized heading output for use with Cetrek autopilots. Each serial port can be independently programmed to output data at a rate of 1 Hz to 20 Hz, selectable in 1 Hz increments. The default data rate is 10 Hz.

Table C-1
NMEA1 Magnetic Heading Output

NMEA1 Magnetic Heading (HDM)

Communication:	4800 baud, 1 start bit, 8 data bits, 1 stop bit, no parity	
Update rate:	Selectable at 1 to 20 Hz (10 Hz default)	
Sentence type:	$HCHDM,XXX.X,M,* hh <CR> <LF>	
Sentence breakdown:	HCHDM	NMEA talker and sentence ID
	XXX.X	Stabilized magnetic heading in degrees and tenths
	M	Magnetic heading, ASCII hex 0x4D
	*	ASCII hex 0x2A
	hh	Checksum
	CR	Carriage return, ASCII hex 0x0D
	LF	Line feed, ASCII hex 0x0A

Table C-2
NMEA2 Magnetic Heading Output

NMEA2 Magnetic Heading (HDG)

Communication:	4800 baud, 1 start bit, 8 data bits, 1 stop bit, no parity	
Update rate:	Selectable at 1 to 20 Hz (10 Hz default)	
Sentence type:	$HCHDG,XXX.X, *hh <CR> <LF>	
Sentence breakdown:	HCHDG	NMEA talker and sentence ID
	XXX.X	Stabilized magnetic heading in degrees and tenths
	*	ASCII hex 0x2A
	hh	Checksum
	CR	Carriage return, ASCII hex 0x0D
	LF	Line feed, ASCII hex 0x0A

NMEA3 True Heading (HDT)

Communication:	4800 baud, 1 start bit, 8 data bits, 1 stop bit, no parity	
Update rate:	Selectable at 1 to 20 Hz (10 Hz default)	
Sentence type:	$HCHDT,XXX.X,T *hh <CR> <LF>	
Sentence breakdown:	HCHDT	NMEA talker and sentence ID
	XXX.X	Stabilized true heading in degrees and tenths
	T	True heading, ASCII hex 0x54
	*	ASCII hex 0x2A
	hh	Checksum
	CR	Carriage return, ASCII hex 0x0D
	LF	Line feed, ASCII hex 0x0A

Table C-3
NMEA3 True Heading Output

True Heading is only available when GPS data input is received by the ADCU. Section 2.4.5, True North Capability, *provides complete details.*

KVH Format Special Output Sentence (Set at Factory Only)

Communication:	9600 baud, 1 start bit, 8 data bits, 1 stop bit, no parity	
Update rate:	Selectable at 1 to 20 Hz (10 Hz default)	
Sentence type:	%AAAA,BBBB,CCCC <CR> <LF>	
Sentence breakdown:	%	Sentence identifier
	AAAA	Stabilized pitch attitude in tenths of degrees
	BBBB	Stabilized roll attitude in tenths of degrees
	CCCC	Stabilized magnetic azimuth in tenths of degrees
	CR	Carriage return, ASCII hex 0x0D
	LF	Line feed, ASCII hex 0x0A

Table C-4
KVH Output

Table C-5
Cetrek Output

Cetrek Output Sentence

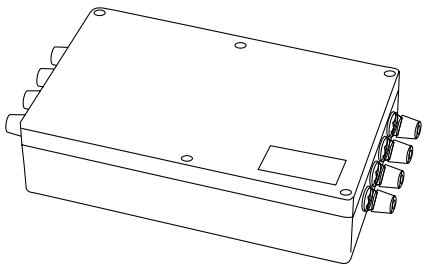
Communication:	4800 baud, 1 start bit, 8 data bits, 1 stop bit, no parity	
Update rate:	Selectable at 1 to 20 Hz (10 Hz default)	
Sentence type:	$$MSB LSB B C Status D <CR> <LF>	
Sentence breakdown:	MSB LSB	Binary value 0 to 1023, equal to 0.0 to 359.6 degrees stabilized magnetic heading
	B	ASCII hex 0x00
	C	ASCII hex 0x00
	Status	ASCII hex 0x43
	D	ASCII hex 0xAA
	CR	Carriage return, ASCII hex 0x0D
	LF	Line feed, ASCII hex 0x0A

C.3 Furuno Output

The Furuno output is a proprietary message format typically used with Furuno and other brands of radars and autopilots. Two user-configurable options are available: true or magnetic heading and 25 millisecond (40 Hz) or 200 millisecond (5 Hz) data rate. The default rate is 200 millisecond/5 Hz.

C.3.1 Optional Stepper Components

Figure C-1
Stepper Interface



An optional interface unit is available to generate a stepper output. The stepper interface uses an NMEA HDM or HDT serial message input to generate the stepper signal format.
The stepper signal replaces traditional gyro outputs used with satellite communication systems, autopilots, and steering displays. The Stepper Interface unit is shown in Figure C-1 while the specifications are presented in Table C-6.

Please refer to the Stepper Interface User Manual for specific wiring instructions.

Stepper Interface

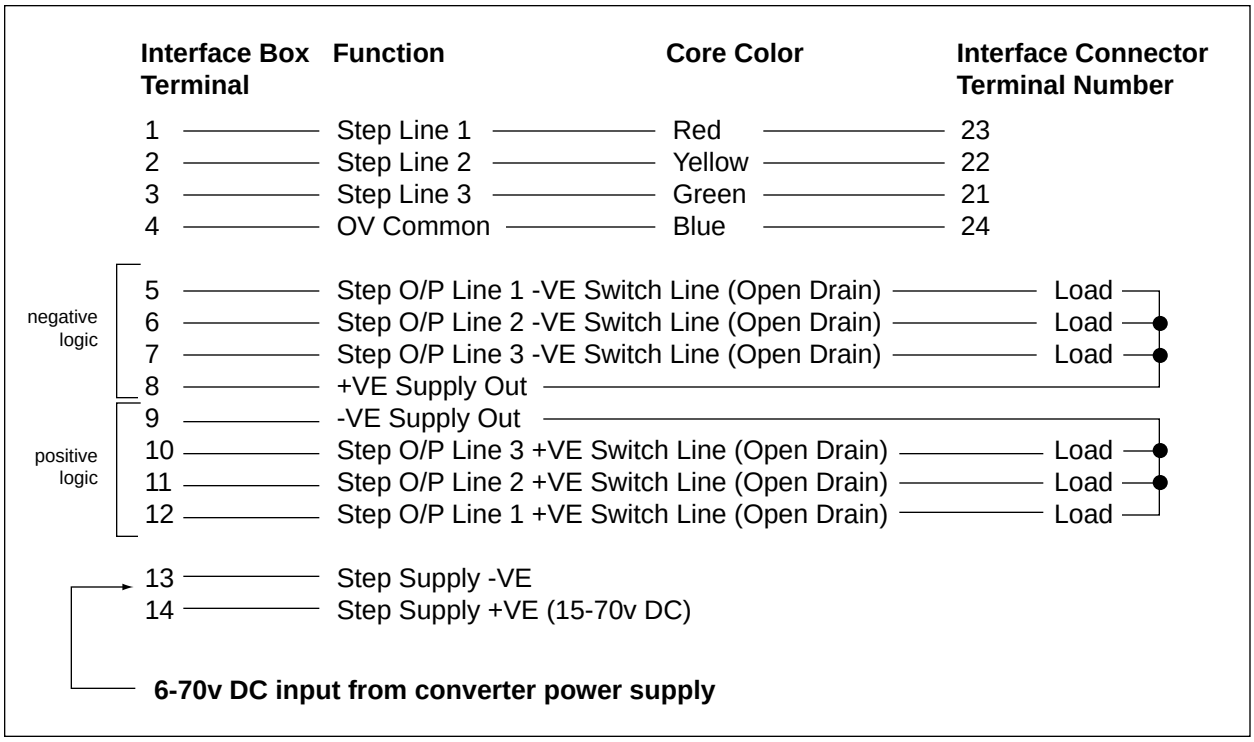
Dimensions	10.5" (267 mm) x 5.8" (147 mm) x 2.3" (58 mm)
Weight	13 oz (370 gm)
Input	NMEA 0183
Stepper Output	3, 6, 12, 24 steps/degree
Output Voltage	5v standard (30-70v option also available: Part Number 19-0089)

Table C-6
Stepper Interface Specifications

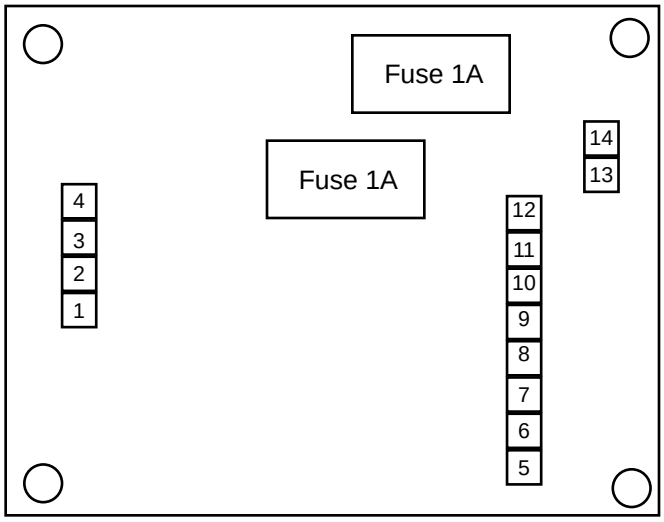
Stepper Voltage Converter

A Stepper Voltage Converter (KVH Part Number 19-0089) is needed when the receiving stepper device employs a reference voltage greater than the 5 volt maximum available from the Stepper Interface. The converter is wired directly between the Stepper Interface output and the receiving equipment to provide the necessary reference voltage. An external 6-70v DC power supply is required to provide the necessary voltage to this device. Figure C-2 on the following page shows the Stepper Voltage wiring connections and wiring diagram.

Figure C-2
Optional 6-70v Stepper Voltage Converter Wiring Diagram

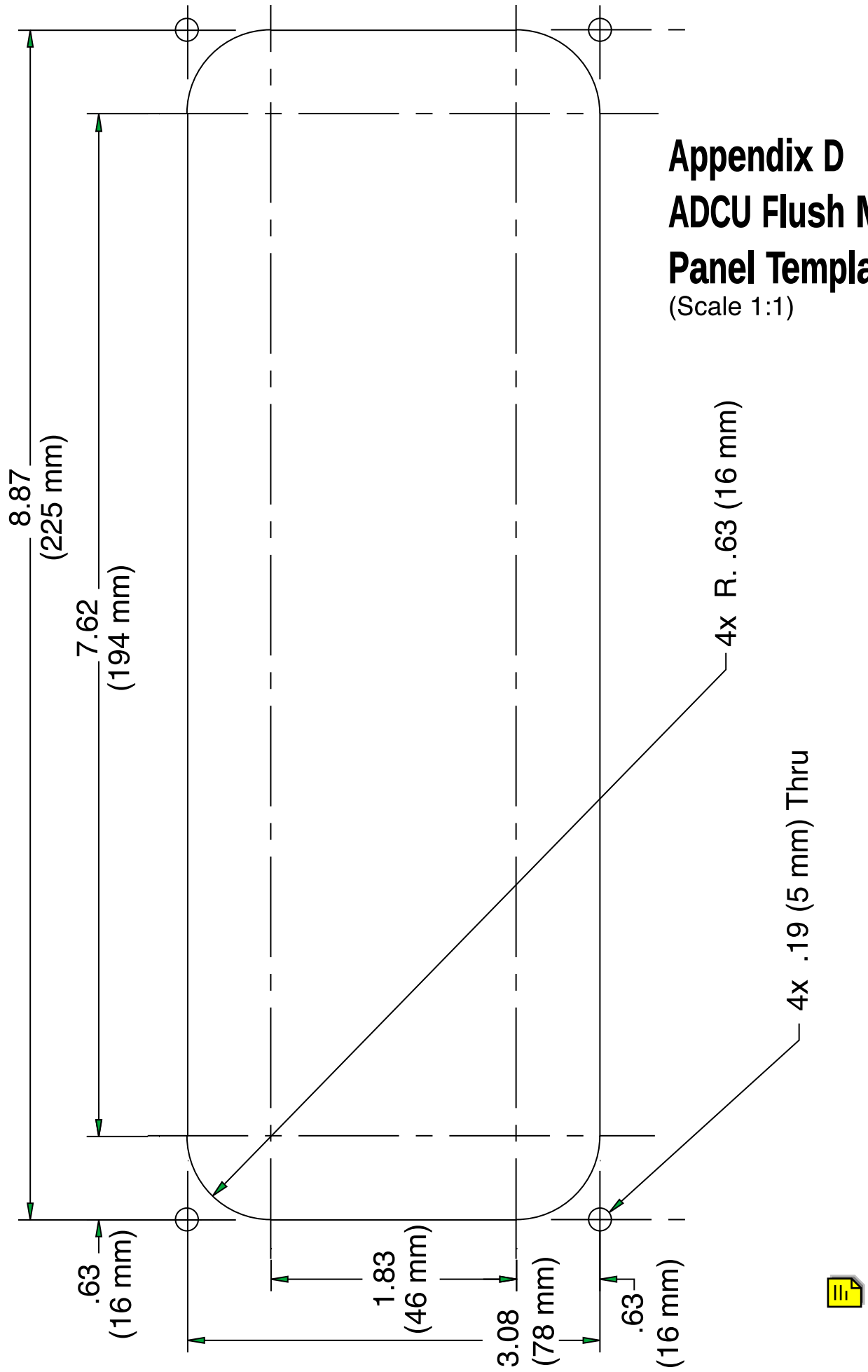

Interface Box Terminal
Function
Core Color
Interface Connector Terminal Number
1 Step Line 1 Red 23
2 Step Line 2 Yellow 22
3 Step Line 3 Green 21
4 OV Common Blue 24
negative logic
5 Step O/P Line 1 -VE Switch Line (Open Drain) Load
6 Step O/P Line 2 -VE Switch Line (Open Drain) Load
7 Step O/P Line 3 -VE Switch Line (Open Drain) Load
8 +VE Supply Out
positive logic
9 -VE Supply Out
10 Step O/P Line 3 +VE Switch Line (Open Drain) Load
11 Step O/P Line 2 +VE Switch Line (Open Drain) Load
12 Step O/P Line 1 +VE Switch Line (Open Drain) Load
13 Step Supply -VE
14 Step Supply +VE (15-70v DC)
6-70v DC input from converter power supply

The step supply is internally fused at 1 amp. Step output lines are opto-isolated from step input lines.



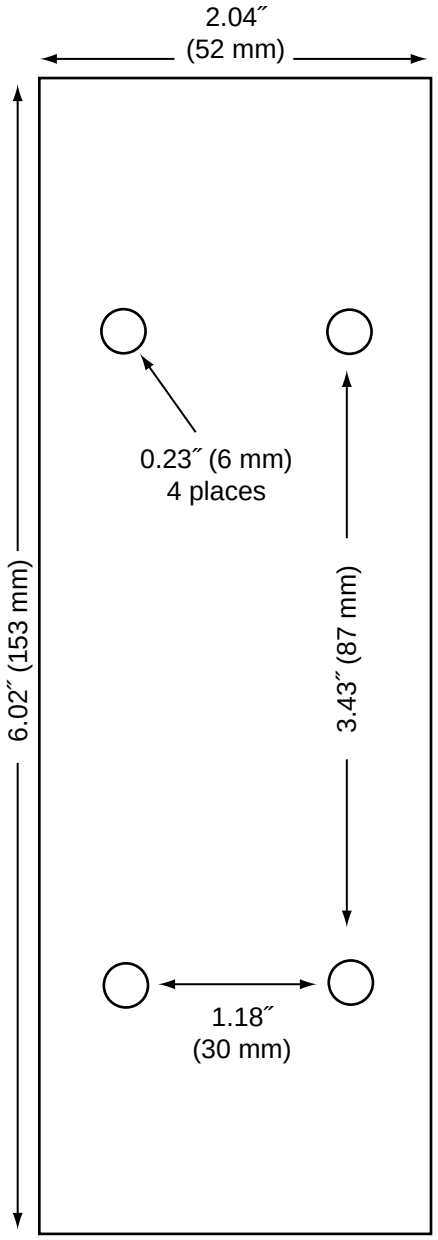
Appendix D
ADCU Flush Mount Panel Template

(Scale 1:1)

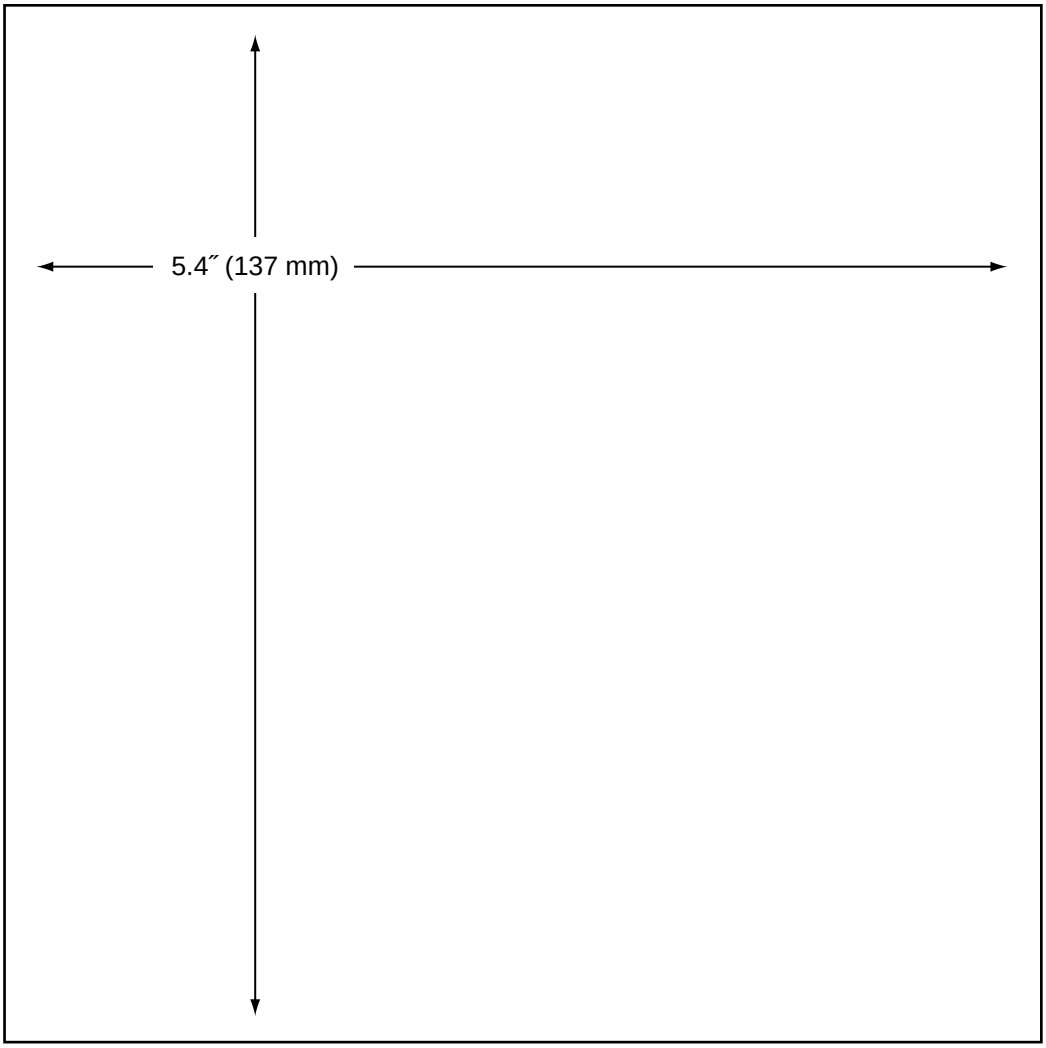


Appendix E
Rotating Card Display Mounting Templates

Template E-1 Rotating Card Display Bracket Mounting



Template E-2 Rotating Card Display Panel Mounting



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Limited Warranty on Hardware

KVH Industries, Inc. warrants the KVH product purchased against defects in materials for a period of TWO (2) years and against labor costs for a period of ONE (1) year from the date of original retail purchase by the original purchaser. It is the customer's responsibility to verify the date of purchase by returning the warranty card included with the product to KVH within 30 days of purchase, or by providing a copy of a dated sales receipt for the KVH product under warranty with the warranty claim. If this date cannot be verified, the warranty period will begin 30 days after the date of manufacture of the original product purchased.

If you discover a defect, KVH will, at its option, repair, replace or refund the purchase price of the product at no charge to you, provided you return it during the warranty period, transportation charges prepaid, to the factory direct. Please attach your name, address, telephone number, a description of the problem and a copy of the bill of sale or sales receipt as proof of date of original retail purchase, to each product returned to warranty service. Alternatively, you may bring the product to an Authorized KVH dealer distributor for repair. If the product was installed by an Authorized KVH dealer/distributor (identified with the KVH Authorized dealer/distributor list), KVH will cover the dealer's/distributor's labor charges for warranty repairs, provided the dealer/distributor contacts KVH for pre-approval of the charges.

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Return Authorization

A Return Material Authorization is required prior to returning the product to KVH Industries. Please call our Technical Support Department at (401) 847-3327 or send an e-mail to techs@kvh.com to obtain the RMA number. Write the number in large, clear characters on the outside of the box. To avoid confusion and misunderstandings, shipments without an RMA number clearly visible on the outside box will be refused and returned to you at your expense. If possible, use the original box and packing material to protect the equipment from damage in shipment. KVH assumes no responsibility for warranty shipments from the customer to the factory if not shipped in the manner prescribed above.

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